Chapter 3.1 SURFACE WATER MONITORING PROGRAMS

Ambient Water Quality Monitoring (AWQM)

Sixteen hundred and twenty (1,620) stations were sampled during this reporting period to determine water quality trends and conditions in the state for identification and ranking of Virginia's priority water bodies and for reporting purposes in this 305(b) Water Quality Assessment Report. These stations include 1,349 ambient water quality stations and 271 biological monitoring stations. Stations are located to gather information from industrial, urban, rural, and undeveloped areas of the state. These data are gathered near industrial and municipal discharges, nonpoint source areas, public water supplies, unaffected areas, and previously unassessed areas. In this way, stream miles at risk from major pollution sources are well documented, as are those where pollution risk is suspected or unknown. Station selections are made by regional office personnel who are most familiar with local conditions and concerns.

The number of stations representing a particular type of stream area, the types of samples collected, the parameters analyzed, and the sampling frequency all vary with prevailing conditions, and program emphasis. Types of samples collected include water, sediment, fish tissue, and benthos. All stations are monitored for conventional parameters and about one-third are monitored for toxics in the water column and/or in the sediments. Areas with potentially greater risk are sampled more frequently, with more types of samples being collected. As the risk or the need to document the risk decreases, the sampling frequency and the number of the types of samples collected decreases. This variation allows greater resource flexibility. Table 3.1-1 gives an outline of the frequency of sampling and parameters covered for given sample types.

The monitoring network includes ambient water quality, benthic, Chesapeake Bay tributary, and fish tissue monitoring stations, as well as stations located specifically for special studies. During this reporting period, DEQ collected approximately 39,000 samples.

Each basin summary, found in Chapter 2.6 of this report, lists the ambient water quality monitoring (AWQM) and biological (benthic) monitoring summary data within the basin. In some basins, STORET data produced from Tennessee Valley Authority (TVA) and USGS monitoring operations are included in order to provide better assessment of water quality. Summaries of the sampling data collected at each station during the reporting period are provided in Appendix B of this report. All chemical and physical data (except for special studies) collected at the AWQM stations are entered into EPA's STORET database.

Data Management

Virginia uses EPA's STORET database for data storage. DEQ uses an electronic data transfer system whereby data are reported by the laboratory, screened for QA/QC problems and standards violations, and sent to STORET. Restricted DEQ personnel may correct, delete or erase stored data using an electronic interface with STORET. Data are managed by regional and central office personnel using routines resident in the STORET environment and by downloading STORET data to local PC environments and using in-house software. All DEQ monitoring data are available on-line to anyone with STORET access. Data can be provided to persons without such access in hard copy and digital formats by contacting the DEQ STORET coordinator.

Water	Sediment	Tissue	Benthos
Parameters:			
DO	Metals	Species	Population
Temperature	Pesticides	Length	Variation
pH	Organics	Weight	Diversity
Bacteria			
Solids			
Nutrients			
Conductivity			
Salinity			
Secchi			
Alkalinity			
Acidity			
Total Solids			
Suspended Solids			
Dissolved Solids			
Silica			
Sulfide			
Color			
Tannin & Lignin			
BOD			
COD			
TOC			
Hardness			
Chloride			
Fluoride			
Metals			
Pesticides			
Organics			
Chlorophyll			
Algae			
Sampling Frequency:			
Annual	Annual	Annual	Semiannual
Semiannual	Semiannual	Semiannual	
Quarterly	Quarterly	Quarterly	
Monthly			

Beginning in January 1999, water quality data will be electronically stored in STORETX, a new database application replacing the current STORET database. STORETX will store additional data, including expanded station descriptions, quality control data from the laboratory, more complex

project information, and better biological parameter storage.

Fish Tissue Monitoring Program

Sampling stations used in this program are selected for their proximity to industrial areas, importance as major waterways and fishing areas, sites previously unsampled and/or sites identified as areas of possible contamination.

Two composite samples of edible fillets, obtained from fish species normally consumed by humans, were collected at each sampling station in order to address human health concerns. Ecosystem contamination data was collected at each station by collecting one whole body composite sample of a bottom-feeding species. Samples were analyzed for heavy metals, pesticides, and trace organics. The following is a list of those compounds analyzed.

Metals: **Pesticides**:

Arsenic Aldrin		Endosulfan (alpha)
Beryllium	Dieldrin	Endosulfan (beta)
Cadmium	Endrin	PCBs
Chromium	DDT	Toxaphene
Copper	DDE	Benzene hexachloride (alpha)
Lead	DDD	Benzene hexachloride (beta)
Mercury	Chlordane	Lindane
Nickel	Heptachlor	Benzene hexachloride (delta)
Selenium	Heptachlor epoxide	Chlorpyrifos-methyl
Silver	Hexachlorobenzene	Mirex
Thallium	Methoxychlor	Oxychlordane
Zinc	Nonachlor	Pentachloroanisole

Other Organics:

Acenapthane	Diethylphthalate
Acenaphthylene	Dimethylphthalate
Anthracene	Fluoranthene
1,2 Benzanthracene	Fluorene
Benzo (a) pyren	Ideno (1,2,3-cd) pyrene
3,4 Benzofluoranthene	Naphthalene
Benzo (k) fluoroanthene	4,6-Dinitro-2-methylphenol
1,1,2, Benzoperylene	N-Nitrososdiphenylamine
4-Bromophenyl phenylether	N-Nitroso-di-N-propylamine
4 Chloro-3-methylphenol	Phenanthrene
2-Chloronaphthalene	Bis (2-ethyl-hexyl) phthalate
4-Chlorophenolphenylether	Butylbenzylphthalate
Chrysene	Di-N-butyllphthalate
Dibenzo (a,h) anthracene	Di-N-octylphthalate
3,3-Dichlorobenzidine	Pyrene
2,4-Dimethylphenol	1,2,4-Trichlorobenzene

Benthic Macroinvertebrate Monitoring Program

The Biological Monitoring Program (BMP) utilizes the study of bottom dwelling macroinvertebrate communities to determine overall water quality. Changes in water quality generally result in changes in the kinds and numbers of these animals which occur in streams or other waterbodies.

The majority of the freshwater benthic macroinvertebrates found in Virginia come from four general groups: insects, molluscs, crustaceans, and annelid worms. Beside being the major intermediate constituent of the aquatic food chain, benthic macroinvertebrates are "living recorders" of past and present water quality conditions. This is due to their relative immobility and their variable resistance to the diverse contaminants which can be introduced into streams. No two groups of benthic organisms have the same limiting factor for the various chemical and physical constituents encountered in the aquatic ecosystem. The community structure of these organisms provides the basis for the biological analysis of water quality.

The BMP is composed of stations examined annually during the spring and fall. Qualitative and semiquantitative biological monitoring has been conducted by the agency since the early 1970's. The US EPA Rapid Bioassessment Protocol (RBP) II was employed beginning in the fall of 1990, to utilize standardized and repeatable methodology. The RBP's produce water quality ratings of nonimpaired, moderately impaired, and severely impaired instead of the former ratings of good, fair and poor.

The procedure evaluates the macroinvertebrate community by comparing ambient monitoring “network” stations to “reference” sites. A reference site is one which has been judged to be representative of a natural, unimpaired waterbody. The RBP evaluation also accounts for the natural variation noted in streams in different ecoregions. One additional product of the RBP evaluation is a habitat assessment. This provides information on the comparability of each stream station to the reference site.

The results of data analyses and locations of stations are presented in Appendix B of this report. Like physical and chemical water quality monitoring data, biological monitoring data are used to assess water quality for support of designated uses and the Clean Water Act fishable and swimmable goals.

Volunteer Monitoring Program

The 1998 305(b) report is the fifth in which volunteer-collected data were recognized when making water quality assessments. Volunteer data were obtained from the Alliance for the Chesapeake Bay (ACB) and the Izaak Walton League of America (IWLA). Both organizations maintain volunteer water quality monitoring networks in Virginia. Interest in environmental stewardship in the Commonwealth is strong, as evidenced by the yearly increases in volunteer monitoring programs throughout the state. As the number of volunteer participants grows, so too, does the number of stations evaluated by these organizations. Data collected by citizen monitors will continue to be an important element in Virginia’s attempt at a thorough statewide water assessment.

Volunteers for the ACB have been monitoring water quality since 1985. This program is administered under the guidance of the Monitoring Subcommittee to the Implementation Committee for the interstate Chesapeake Bay Program. In Virginia, stations have been established on the James, York, Rappahannock, Piankatank, Potomac, Elizabeth, Chickahominy, Mattaponi, Pamunkey and Lynnhaven River, as well as on the creeks and embayments of the Eastern Shore. Air and water temperature, Secchi disk depth, pH, DO, and salinity are measured at all ACB sites. Field observations of water conditions and color, weather, and general conditions of the site are also made at every

sampling location. At seven monitoring stations, samples were taken for inorganic nutrients (nitrate, ammonia, nitrite, and ortho-phosphate) in addition to their standard parameters. At most sampling locations, physical and chemical monitoring samples are taken on a weekly basis. The citizen monitors for ACB work from a sampling protocol manual developed by the Alliance and a Quality Assurance and Control Project Plan that has been approved by the Environmental Protection Agency and Virginia DEQ. All volunteers must complete a rigorous initial training class and two quality control sessions each year which are administered by the Virginia coordinator for the Alliance.

The IWLA maintains a statewide volunteer water quality monitoring network through its "Save Our Streams" Program. Save Our Streams volunteers are trained in accordance with EPA-approved quality assurance/quality control guidelines to monitor benthic macroinvertebrate populations and assess physical stream characteristics. The program is coordinated on a statewide level through the Virginia Chapter of the IWLA. Surveys are made at regular intervals from each of more than 303 sites in 46 counties throughout Virginia. The resulting data are compiled and reported to the DEQ and the DCR.

Chapter 3.2 ASSESSMENT METHODOLOGY

Virginia's biennial water quality assessment begins by analyzing the water quality data from ambient, biological, sediment and fish tissue monitoring stations. The results of these comprehensive data analysis are compared with both numeric and narrative goals contained in the Water Quality Standards (WQS). The results of these comparisons are presented in the 305(b) and 303(d) reports. The WQS are provisions of State and/or Federal Law which contain the designated uses for the waters of the Commonwealth. Included in the standards are the numerical and narrative criteria for protecting these uses.

There are two basic types of water quality data used in the assessment process. "**Monitored**" data comes from the collection and analysis of chemical, biological, and physical samples taken by DEQ, U.S. Geological Survey, TVA, and/or other special studies. Monitored data is obtained through a sampling and testing protocol which has been approved by EPA. The second type of data used in the assessment is called "**evaluative**" data. This physical, chemical, or biological data is primarily obtained from sources where there is not an EPA approved sampling and testing protocol or some other water quality "predictive" assessment technique. For the 305(b) report, only EPA approved "monitored" data is used to classify waters "impaired" due to the assessment confidence associated with quality control/quality assurance monitoring requirements." Evaluative" data are used to rank waters for potential water quality degradation or impairment and are used to assist in the siting of monitoring stations in the designated high ranking waters.

Designated Uses of Virginia's Waters

Virginia's water quality standards contain three basic designated uses of the state's waters and two associated uses. In the biennial water quality assessment process, a total of five designated uses are assessed. These designated uses are **aquatic life use, recreational use (swimming), use as public water supply.** Along with these three primary uses, **fish consumption and shellfish consumption,** which are sub-categories of the aquatic life use designated in the water quality standards, are assessed. Swimming use is assessed to represent the primary and secondary water contact recreational use.

Aquatic Life Use:

Includes the propagation, growth, and protection of a balanced indigenous population of aquatic life (including game and marketable fish) which may be expected to inhabit the waters.

Support of this use is determined by the assessment of conventional pollutants (dissolved oxygen, pH and temperature); toxic pollutants in the water column, toxic pollutant analysis of fish tissue and sediments and biological assessment of benthic communities.

Fish Consumption Use:

Support of this use is determined based on advisories and restrictions issued by the Virginia Department of Health (VDH). The public is advised that fish consumption is prohibited for the general population or there is an advisory that fish should not be consumed by the general population or subpopulations at greater risk such as children or pregnant women.

Shellfish Consumption Use:

Support of this use is based on restrictive actions for the harvesting and marketing of shellfish resources made by the Division of Shellfish Sanitation (DSS) of the Virginia Department of Health.

Four classifications are used to describe shellfish waters. They are approved, conditionally approved, restricted, and prohibited. Approved areas are waters from which shellfish may be taken for direct marketing at all times. Conditionally approved areas are waters where the quality may be affected by a seasonal population increase or sporadic use of a dock or harbor facility. Restrictive areas are waters where a sanitary survey indicates a limited degree of contaminants which makes it unsafe to market shellfish for immediate consumption. Shellfish harvested in these areas must be moved to an approved area for a certain length of time to allow for depuration before marketing. Prohibited areas are waters where the sanitary survey indicates dangerous numbers of pathogenic microorganisms or other contaminates which could affect human helth. Shellfish cannot be harvested or relayed for purification in prohibited areas. Those areas which are determined as non-productive for shellfish will not be assessed for this use.

Swimming Use:

Includes swimming and other primary and secondary water contact recreation uses. Support of this use is based on fecal coliform bacteria data and the Department of Health (VDH) beach closures.

Public Water Supply Use:

Waters which are used for public drinking water supply are listed in the water quality standards and protected by additional standards which are applicable to these waters. Support of this use is based on Virginia Department of Health closures or advisories.

Table 3.2-1 is a summary of the designated uses and the criteria used to demonstrate the support of the associated designated uses.

Table 3.2-1 Designated Use Matrix

NO.	Designated Use	Support of Use Demonstrated By
1	Aquatic Life Use	Conventional Pollutants (DO, pH, Temp.); Toxics in water column; Fish tissue and sediments; Biological evaluation.
2	Fish Consumption Use	Advisories and restrictions issued by VDH.
3	Shellfish Consumption Use	Restrictive actions for harvesting and marketing of shellfish resources made by Div. of Shellfish Sanitation of VDH.
4	Swimming Use	Conventional Pollutant (Fecal Coliform Bacteria) and/or beach closures
5	Public Water Supply Use	Closures or advisories by VDH.

Designated Use Support Criteria

Fully Supporting:

Conventional Pollutants:

Waters fully supporting the designated uses can have up to 10% violations of a water quality

standards numeric criteria for conventional pollutants such as fecal coliform bacteria, dissolved oxygen, temperature, and pH. This procedure is based on EPA guidance which recommends states use a violation rate of water quality standards in the 0-10% range as fully supporting the designated uses. Data sets containing less than 13 observations are generally considered as insufficient data to statistically determine full support. The determination of the percentage exceeding the standard for conventional pollutants is determined by a binomial assessment method rather than an arithmetic percentage of number of exceedances divided by the total number of samples.

Toxic Pollutants in the Water Column with Water Quality Standards:

For toxic pollutant assessmentof the water column, waters where the 97th percentile of the data is less than the water quality standard are generally considered fully supporting. The 97th percentile is determined by using DEQ's computer analysis method (Standard.exe) which is used in DEQ's VPDES permitting program. Additional information on the analysis of toxic data is described in Part VII Section 3 of the DEQ 305(b)/303(d) guidance manual.

Biological Data:

For Benthic Community assessment, data for the overall 5 year assessment period is rated as not impaired or slightly impaired where no biological assemblage (e.g. fish, macro invertebrates or algae) has been modified significantly beyond the natural range of reference conditions.

Fish Advisories:

Waters where the Department of Health has issued no fish advisories or prohibitions.

Shellfish Advisories:

Those growing areas where no restriction or prohibition on shellfish harvesting is imposed as indicated by the Department of Shellfish Sanitation (DSS) summary dated June 30, 1997.

Those growing areas where prohibitions and restrictions are due solely to the presence of a VPDES permitted outfall.

Discussion: In the meeting held with DSS on June 9, 1997, it was agreed that those shellfish growing waters which were prohibited or restricted for shellfish harvesting due solely to the presence of a VPDES outfall permitted by the authorized state agency would not be considered impaired. The rationale is the management decision made during the VPDES permit issuance process which removed shellfish harvesting as a beneficial use from the area impacted by the discharge.

Beach Closures:

No VDH beach closures during the 5 year assessment period.

Drinking Water Source Closures:

No VDH drinking water source closures during the 5 year assessment period.

Fully Supporting But Threatened

Threatened Waters:

Waters for which “evaluated” data, trend analysis, or other water quality indicators show an apparent decline in water quality or a potential water quality problem. Waters are designated threatened where there is a probable loss of a designated use documented by ancillary data such as recurrent fish kills or pollution documented by non-agency studies or reports. Threatened waters generally have some violations of water quality standards for conventional parameters or potential for moderately impaired biological conditions and should include additional monitoring.

Conventional Parameters and Fish Tissue/Sediment Contamination:

For conventional parameters, waters slightly exceeding the 10% violation rate based on the number of violations divided by the total number of samples but less than 10% based on the binomial distribution. Trend analysis on monitored data show a decline in water quality. Evaluated data shows a potential water quality problem.

For fish tissue or sediment contaminantion, waters exceeding a screening value (SV) or ER-M value, respectively. If ER-M value does not exist, then the 99th percentile value is used.

Biological Data:

Benthic Community data for the 5 year assessment period with a single rating of moderately impaired using RB II methodology. Evaluated benthic data or best professional judgement reveals potential water quality problems. Another biological assessment should be scheduled.

Shellfish Advisories:

Those growing areas which DSS has classified as conditionally approved. This would include those condemnations listed as seasonal condemnations in the DSS summary dated June 30, 1997.

Discussion: The restriction on direct marketing and requirement for relaying is in effect during a period of the year when virtually no harvesting occurs. During the period of the year when harvesting is active, the activity requiring the conditional approval is absent and no restrictions on marketability are imposed. Therefore, there is no significant impact to the resource. The area is considered threatened due to the presence of the activity which causes the temporary harvesting restriction.

Beach Closure:

One short term (less than one week in duration) VDH beach closure within the 5 year assessment cycle with a low probability, based on best professional judgement, that the pollution will reoccur. The source of the pollution causing the closure is generally transient and there are no VDH plans to implement pollution reduction measures or controls.

Drinking Water Source Closure:

One short term VDH drinking water source closure during the 5 year assessment cycle with a low probability that the pollution will reoccur. The source of the pollution is generally transient and there are no VDH plans to implement pollution reduction measures or controls.

Impaired Waters

Conventional Parameters:

Impaired waters are those with long term or chronic water quality problems. Impaired waters are designated **partially supporting** or **not supporting** any of the five designated uses. The number of samples exceeding the standard is used to determine if the water is partially or not supporting. EPA guidance recommends that the states use a violation rate of 11% - 25% for partial support and greater than 25% for not supporting.

Toxic Parameters:

Impaired waters are those which the 97th percentile of the data exceeds the toxic pollutant water quality standard. The toxic standards protect aquatic life and human health uses (water supply). Waters failing to meet one of these uses should be designated as partially supporting. Waters should be designated not supporting when both uses are not met.

Discussion: EPA's 1998 assessment guidance determines partial support from not supporting by the arithmetic percentage (total exceedences / total samples x 100 = arithmetic percent) of samples exceeding the standard. Violations exceeding 10% are not supporting and violations of 10% or less are partially supporting. We do not agree with this method because the toxic standards are parameter and designated use specific. For example, the carcinogen trichlorophenol has a standard for human health use (drinking water) but none for aquatic life. Therefore, a violations in excess of 10% for this parameter can only be for the one designated use and partially supporting. Other toxic pollutants such as aldrin have standards for aquatic life and human health. Violations of the standard for both uses would be designated not supporting.

All localities, PDCs, Health Department Districts, and Soil and Water Conservation Districts are notified and provided information on the impaired waters within their jurisdictional boundaries.

Partially Supporting

Conventional Parameters:

Waters with long term or chronic problems based on the assessment of monitored data. For conventional parameters, violations of water quality standards in the 11-25% range (based on the binomial distribution) are considered a long term or chronic problem and considered partially supporting. Waters with violations in this range are capable of supporting some of the designated uses according to EPA guidance.

Toxic Pollutants:

For toxic parameters, waters violating the quality standard (97th percentile greater than the standard) for one designated use.

Biological Data:

Benthic community data rated as moderately impaired using more than one RBP II survey during the assessment period showing moderate impairment.

Fish Advisories:

Virginia Department of Health fish consumption advisories are considered violations of the general water quality standard and considered partially supporting. Where EPA and the Commonwealth have completed remedial action or decided not to implement control measures to remove or reduce the pollutants such as the kepone in the lower James River, a brief summary of the federal\state action and a statement that a TMDL will not be developed for these waters will be

included in the 303(d) report.

Shellfish Advisories:

Those growing areas which DSS has classified as restricted. This includes all shellfish condemnations which are not seasonal or other prohibitions as listed in the DSS summary dated June 30, 1997.

Discussion: The loss of resource in the restricted areas is a partial loss since the DSS allows harvesting and marketing after relay for cleansing of contamination. The waters therefore partially support the beneficial shellfish use.

Beach Closures:

One or more VDH beach closures of less than one week duration within the 5 year assessment cycle with a medium probability, based on best professional judgement, that the pollution will reoccur. There are VDH plans to implement pollution reduction measures or controls.

Drinking Water Source Closure:

One or more VDH drinking water source closures within the 5 year assessment cycle with a high probability that the pollution will reoccur. There are plans to implement pollution reduction measures or controls.

Not Supporting

Conventional Parameters:

Waters with severe long term or chronic problems based on the assessment of monitored data. Waters with conventional parameter violations of greater than 25% (based on the binomial distribution) do not support any of the designated uses according to EPA guidance.

Toxic Pollutants:

Waters where the 97th percentile of the toxic parameter exceeds the water quality standard for more than one designated use.

Biological Data:

Benthic Community data for the 5 year assessment period rated as severely impaired.

Fish Consumption Advisories:

Virginia Department of Health fish consumption prohibitions are considered violations of the general water quality standard and considered as not supporting.

Shellfish Advisories:

Those growing areas which DSS has classified as prohibited, with the exception of those areas where prohibitions and restrictions are due solely to the presence of a VPDES permitted outfall. This includes those shellfish condemnations which are listed as "...it shall be unlawful for any person, firm, or corporation to take shellfish from these areas, for any purpose."

Discussion: The loss of resource in the prohibited areas is a total loss since the DSS does not allow relaying to remove contamination, harvesting, or marketing of the shellfish resource which may be present. The prohibitions and restrictions due solely to the presence of a VPDES permitted outfall are not considered as loss of beneficial use as explained in the discussion following the "Fully Supporting" section.

Beach Closures:

One or more VDH beach closures of more than one week duration during the five year period with a high probability, based on best professional judgement, that the pollution will reoccur and additional closures will result. VDH initiates plans to implement pollution reduction measures or controls.

Drinking Water Source Closure:

One or more VDH drinking water source closures with a high probability that the pollution will reoccur. There are VDH plans to implement pollution reduction measures or controls.

Waters Not Meeting Water Quality Standards Due to Natural Conditions

Waters which are assessed as exceeding 10% violations of standards (based on the binomial distribution) and the source of violations is due to naturally occurring conditions such as low DO in slow flowing swamp waters are not considered impaired. These violations are not a result of or related to human activity, past or present. The Commonwealth will not attempt to implement control measures, pollution reduction projects, or develop TMDLs for these waters.

Table 3.2-2 summarizes the designated use support criteria used in the water quality assessment.

Table 3.2-2 Designated Use Support Criteria Matrix

	Fully Supporting	**Fully Supporting But Threatened**	**Partially Supporting**	**Not Supporting**
Conventional Pollutants	r≤10% binomial	10% fix≥ r ≤10% binomial	10%bin < r ≤ 25%binomial	r > 25%bin
Toxic Pollutants	97th %tile < WQS	NA	97th %tile > WQS for **one** designated use (aquatic life or human health/water supply)	97th %tile > WQS for **more than one** designated use
Biological Data	Not Impaired or Slightly Impaired	Moderately Impaired; Evaluated data show potential WQ problems	Moderately Impaired (**more than one surveys show moderate impairment**)	Severely Impaired
Fish				

Advisories	None	NA	Yes	Yes
Shellfish Advisories	None	Areas classified as **Conditionally Approved** (includes seasonal condemnations)	Areas classified as **Restricted**	Areas classified as **Prohibited** (exception: VPDES outfall areas)
Beach Closures	None	One short term VDH closure with low probability of recurrence (pollution source transient and no VDH plans to implement any controls)	One or more VDH closure with medium probability of recurrence (VDH preparing plans to implement controls measures)	One or more VDH closure with high probability of recurrence (VDH initiates plans to implement controls measures)
Drinking Water Source Closures	None	One short term VDH closure with low probability of recurrence (pollution source transient and no VDH plans to implement any controls)	One or more VDH closure with medium probability of recurrence (VDH preparing plans to implement controls measures)	One or more VDH closure with high probability of recurrence (VDH initiates plans to implement controls measures)

Fish Tissue Data*	**Sediment Data***
If one or more Level 1 samples exceed one or more risk based SVs ⇒ threatened for fish consumption and aquatic life. •Cause: violation of SV for affected parameter •Source: unknown	If one or more ER-M SV(s) or if no ER-M exists, 99th percentile SV exceed ⇒ threatened for aquatic life. •Cause: violation of SV for affected parameter

*No water body should be designated impaired (partially or not supporting) based on Level 1 Fish Tissue or Sediment data alone.

Delineation of Monitored Waters and Segments

The Virginia Department of Environmental Quality (DEQ) has approximately 1,349 active Ambient Water Quality Monitoring (AWQM) stations and 271 (69 reference) biological stations statewide. The AWQM stations are monitored bi-monthly, monthly or quarterly, while the biological stations are monitored twice a year usually in the Spring and Fall. Monitoring programs can be designed based on conventional (source targeted) or probability or a combination of the two. Each monitoring program design has its advantages and disadvantages. In the past, most of DEQ's monitoring strategy has been based on the conventional approach. Many of the stations were selected

due to point sources problems (VPDES permit dischargers). Over the recent years, some stations have been selected to monitor nonpoint source problems. In past 305(b) water quality assessment reports, there has been little consistency between the regions for determining the miles of stream impairment associated with each monitoring station. Most regions have strived to have at least one AWQM station in a watershed. If that station is determined to be representative of that watershed, then the total stream miles associated with that watershed were considered assessed. When an assessment revealed an impairment in water quality then the assessed miles for that specific monitoring station have been limited to a distance upstream and downstream which contains no significant change to water or habitat quality. The remaining stream miles have been evaluated as not assessed. In order to provide consistency between the regions and to get an accurate number of assessed stream miles in the state, the following guidelines are recommended:

1) One monitoring station should not be used to assess an entire watershed unless land use, source, and habitat are relatively homogeneous.

2) Typically no more than 10 miles of stream should be associated with a monitoring station for conventional pollutants as per EPA guidance. Miles assessed for a toxic pollutant or biological impairment may vary from the miles assessed for conventional pollutants.

3) When determining the miles assessed for a monitoring station, the following items need to be considered:

    a) point or nonpoint source input to a stream or its tributaries,
    b) changes in watershed characteristics such as land use,
    c) changes in riparian vegetation, stream banks, substrate, slope, or channel morphology,
    d) large tributary or diversion, or
    e) hydrologic modification such as a channelization or a dam.

It is recommended that the above approach be phased in over the next couple of 305(b) assessment periods due to the many different considerations which must be made especially for physically or geographically changing watersheds.

Water Quality Data Assessment Methodology for Conventional Parameters

DEQ makes a biennial report to Virginia's citizens and EPA on the condition of its waters. The waters are evaluated in terms of whether five designated uses are met: 1) aquatic life, 2) swimming (primary and secondary contact recreation), 3) shellfish harvest, 4) fish consumption, and 5) drinking water use. DEQ employs a statistical method to evaluate waters for the first two uses, aquatic life use and swimming use. The following is a description of the conventional pollutant statistical method used in the 1998 305(b) Report.

Use Impairment:

Through water quality monitoring, DEQ collects data under varied environmental conditions such as cold/warm weather and dry/rainy conditions. Each field datum is compared against the regulatory standard that protects the use. Aquatic life use is maintained if the standards for the conventional pollutants DO, pH, and water temperature are met for greater than 90% of the samples analyzed. Recreation use is maintained if the fecal coliform bacteria standard is met for greater than 90% of the samples analyzed. The task is to determine whether the DO, pH, temperature, and fecal coliform bacteria records indicate that the uses are met. If the uses do not appear to be met, they are

either unconfirmed and listed as threatened or confirmed and listed as impaired.

Initially, each datum for the variables is compared against the regulatory standard. If the standard is exceeded, a violation has occurred. Because environmental conditions vary, it is possible for a violation to occur without signaling a significant environmental change. As Ward and Loftis (1983) quote from Roberts, "one cannot ensure that a reasonable standard will never be violated". Consequently, while some measurements might violate water quality standards, a low violation rate is an insufficient reason to classify a stream as failing its designated use. The tool used by DEQ to differentiate degrees of potential impairment for this reporting period is the Binomial Assessment Method instead of the EPA Fixed Rate Assessment Method.

The EPA Fixed Rate Assessment Method:

EPA has proposed an assessment method for the 305(b) report based on assumptions about the kind and frequency of data needed to support such an assessment. The object is to indicate whether waters are fully, partially, or non supporting for the designated uses. EPA has proposed two thresholds for this purpose, a 10% and a 25% violation rate for a conventional pollutant. These percentages are fixed. Table 3.2-3 summarizes the EPA fixed rate assessment parameters.

Table 3.2-3. EPA fixed rate assessment parameters

Violation Rate of Total Samples Analyzed	Assessment
≤ 10%	meets use
10% < rate < 25%	partially meets use
≥ 25%	fails to meet use

The need for a different statistical approach in Virginia, results from this fixed rate method and its assumptions. The primary concern associated with this method stems from the thresholds being predicated on monthly data. DEQ water quality data are often collected quarterly. DEQ has been encouraged to spread its monitoring efforts over more of the State's waters. To achieve this with a fixed monitoring budget, the average collection frequency changed from monthly to quarterly in 1994. The benefit from this change is more streams and more stream miles can be assessed. The disadvantage is the data collected from each station are fewer. The data set has become wide geographically but shallow in frequency. Consequently, when the biennial assessments are based on two years worth of data, quarterly sampling only generates 8 samples at most over the period. Thus, the data base for assessment is a third of what is expected using the fixed rate method.

A second concern with applying the fixed rate method is that DEQ's monitoring program is diverse. Sampling costs and program intentions generate different monitoring schemes. These differing schemes generate different sized data sets. For example, quarterly ambient monitoring produces 8 data points in a biennium while biomonitoring is semi annual and produces 4 data points in the same period. This variable sample size violates the assumption of constant data records between sampling stations.

Third concern, the routine loss of data and the annual modification of the sampling network exacerbate the sample size problem by increasing the number of possible data set sizes.

Impacts of the 5 Year Period:

The move to include up to 5 years in the 305(b) assessment period does not invalidate the interpretation problems mentioned above. The data sets will be on average 2.5 times larger but the variation in sample size will remain. The difficulty of applying fixed yardsticks to unequal sized data sets will still persist.

Binomial Assessment Method:

The method considers violations as successes in a statistical binomial population and uses the likelihood of the violations in light of two possible population violation rates, 10% and 25%. A pair of hypotheses are established for each violation rate and the chance computed of the sample coming from a population with the specified violation rate. If the sample is statistically likely to have a violation rate of 10% or less, the waters from which the sample is taken are considered suitable for the use. If the sample is statistically likely to have come from a population with a violation rate between 11% and 25%, the waters are classified partially suitable for the use. Finally, if the sample is likely to have come from a population with a violation rate in excess of 25%, the waters are considered to fail the designated use. The error rates are published in the 305(b) report in Appendix B, along with the assessment statement. The statistical conclusion of supporting, partially supporting, or failing the aquatic life/swimmable use is recorded in the Virginia Waterbody System database which is sent to EPA.

The Hypotheses:

Given environmental variability, and given that conventional pollutants in most Virginia streams meet the standards, it is reasonable to hypothesize that waters are clean unless proven polluted. As in a law court, the subject is innocent until proven guilty. The hypotheses that DEQ uses to make assessments of conventional pollutant data follow this pattern. For a conventional water quality variable, DEQ hypothesizes that one of the following is true.

H_o: The water quality variable exceeds the state standard ≤ 0.10 of the time.
H_a: The water quality variable exceeds the state standard > 0.10 of the time.

Based on a sufficiently large sample, if we fail to find a high enough violation rate to reject H_o, we agree that the waters meet the 10% threshold. As discussed later, the sample size must exceed 13 to be considered statistically sufficient to apply the hypothesis test.

Evaluating the Hypotheses:

The binomial distribution is used to determine which hypothesis is likely to be true. The population is assumed to have a violation rate of 0.10. A sample size of **n** with **x** violations are observed. For a monitoring station, record the probability of obtaining **x** violations or more based on the sample size. The chance of making a Type I error (alpha, α) for violation rate is set at 10%. Then, if the probability of the number of violations is greater than 10%, we accept H_o and say that the represented waters meet the regulatory use implied by the variable. If not, we say the waters do not meet the use; we accept H_a. For example, if the fecal coliform violation rate at a monitoring station is 2 out of 8, the probability of that high or higher violation rate, based on the binomial distribution, is 18.69%. Therefore, the waters would meet the swimming use. However, if the violation rate was 3 out of 8, the chance of getting that high a violation rate or higher is only 3.81%, well below the rate of 10%. In this case, the waters would not meet the swimming use.

If a violation record does not meet a use based on the first pair of hypotheses, it is further

evaluated to differentiate whether the not meeting use is partial or full. For this purpose a second set of hypotheses are constructed.

H_o: The water quality variable exceeds the state standard ≤ 0.25 of the time.
H_a: The water quality variable exceeds the state standard > 0.25 of the time.

Based on a sufficiently large sample, if we fail to find a high enough violation rate to reject H_o, we agree that the waters meet the 25% threshold. Because the waters did not meet the first H_o of ≤ 10% but met the second H_o of ≤ 25%, they are classified as partially meeting the designated use. However, if the violation rate leads us to reject the H_o of ≤ 25% and accept H_a of > 25%, then the waters are classified as failing to meet the use. This concludes the evaluation of the sample data. Table 3.2-4 summarizes the complete evaluation process.

Table 3.2-4. Assessment of violation record for a monitoring station.

First set of Hypotheses assuming p = 0.1	Second set of Hypotheses assuming p = 0.25	Conclusion
H_o true	H_o true	waters meet use
H_o false	H_o true	waters partially meet use
H_o false	H_o false	waters fail to meet use

Rules for Using the Binomial Method in the 305(b)/303(d):

At the outset, it is important to state that any rule can be modified based on **best professional judgement**. The data may indicate a specific assessment is warranted but the assessor may have other information that would lead to a modification or change of the assessment. Table 3.2-5 is the guide for assessing waters in terms of aquatic life use and in terms of swimming use in the 305(b) Report. Note that samples smaller than 13 require special assessment compared to samples larger than 13. An **n** = 13 is chosen as the definition of substantial data set because for **n** ≥ 13, needing regulatory action is < 60%. The next cutoff of **n** ≥ 21 has needing regulatory action < 40%. The final cutoff **n** ≥ 50 the needing regulatory action is equal to or less than too much regulatory action taken. Also, the assessment leads to a monitoring action that indicates when sampling should be continued or increased in frequency and when it can be discontinued.

Table 3.2-5. Assessment guide for the 305(b) Report.

n	observed violation rate (r)	P(Over Esti-mation)	P(Under Esti-mation)	Assessment	Sampling Action
< 13	0	n.a.	> 45%	reserve judg.	increase F. until
	0 < r < 10% bin.	n.a.	> 45%	reserve judg.	> 20,reev.
	> 10% bin.	≤ 10%	n.a.	threatened	continue until
	> 25% bin.	≤ 10%	n.a.	threatened	> 20,reeval.
					continue until
					> 20,reeval.
					continue until

					> 20,reeval.
13 - 20	0 < r < fix 10% fix10% < r < 10% bin 10%bin < r < 25%bin > 25%bin.	n.a. n.a. ≤ 10% ≤ 10%	< < 60% < 60% n.a. n.a.	unimpaired threatened partial impaired fully impaired	increase F. until > 20,reev. continue until > 20,reeval. continue until > 20,reeval. continue until > 20,reeval.
21 - 49	0 0 < r < 10% bin 10%bin < r < 25%bin > 25%binl	n.a. n.a. ≤ 10% ≤ 10%	< < 40% < 40% n.a. n.a.	unimpaired unimpaired partial impaired fully impaired	may discontinue continue until > 49,reeval. continue, reevaluate continue, reevaluate
> 49	0 0 < r < 10% bin 10%bin < r < 25%bin > 25%bin	n.a. n.a. ≤ 10% ≤ 10%	< < 10% < 10% n.a. n.a.	unimpaired unimpaired partial impaired fully impaired	may discontinue may discontinue continue, reevaluate continue, reevaluate

notes:
- reserve judg. .. reserve judgement until more data are collected.
- F .. sampling frequency
- reev. .. reevaluate
- n.a. .. not applicable
- fix10% .. the fixed violation rate obtained by (x/n)*100%.
- 10%bin .. the 10% threshold calculated by the binomial method.
- 25%bin .. the 25% threshold calculated by the binomial method.
- partial impaired .. only partially meets the regulated use
- fully impaired .. does not meet the regulated use.

Additional guidance concerning water quality assessment methodology is contained in the draft DEQ WATER QUALITY ASSESSMENT GUIDANCE MANUAL for 305(b) Water Quality report and 303(d) TMDL Priority List report.

Chapter 3.3 WATER QUALITY ASSESSMENT SUMMARY

Statewide summaries of the river miles, estuarine square miles, and coastal linear miles within and bordering Virginia that fully support, partially support, or do not support the overall designated uses for each waterbody are presented in Tables 3.3-2, 3.3-3, 3.3-4 and 3.3-5. Support of the overall uses for each waterbody was determined by examining the support of the five uses. (i.e., aquatic life, fish consumption, shellfishing, swimming, and drinking water). Overall use support for each waterbody was determined by taking the lowest ranking use category which was not fully supporting for the largest size. Example: A five square mile waterbody which was "not supporting" for 2 square miles for swimming and also "partially supporting" for 5 square miles for aquatic life would still have an overall use support of 2 square miles "not supporting" because "not supporting" is a lower ranking than "partially supporting."

As in previous 305(b) reports, conventional pollutant data continued to make up the bulk of water quality assessments. Samples for conventional pollutants were collected at DEQ's ambient monitoring stations and compared to Virginia's water quality standards. Rather than calculating absolute percent violations, DEQ used the binomial procedure described in "The Assessment of Low Frequency Data in Water Quality Management," to determine the degree of use support. The assessment should be objective except where professional judgement indicates that natural causes are responsible for the violations (or the data are suspect). Waters not meeting standards due to natural conditions are listed as impaired but will not be included in the TMDL development list. For Dissolved Oxygen (DO), the instantaneous minimum standard was used to assess exceedences. The degree of use support was determined as follows:

- Fully supporting - for any one of these parameters, Virginia water quality standard is statistically shown to be exceeded in $\leq$ 10% of the measurements taken over the reporting period.
- Partially supporting - for any one of these parameters, Virginia water quality standard is statistically shown to be exceeded in $>$10% to 25% of the measurements taken over the reporting period.
- Not supporting - for any one of these parameters, Virginia water quality standard is statistically shown to be exceeded in $>$25% of the measurements taken over the reporting period.

Table 3.3-1 Virginia Water Quality Standards for Dissolved Oxygen, pH, and Maximum Temperature (VR680-21-01.5)

Class of Waters	Description	Dissolved Oxygen (mg/l)		pH(su)	Maximum Temperature (C°)
		Min.	Daily Avg.		
I	Open Ocean	5.0	--	6.0-9.0	--
II	Estuarine Waters	4.0	5.0	6.0-9.0	--
III	Non-Tidal Waters	4.0	5.0	6.0-9.0	32
IV	Mountainous Zone Waters	4.0	5.0	6.0-9.0	31
V	Put & Take Trout Waters	5.0	6.0	6.0-9.0	21

VI	Natural Trout Waters	6.0	7.0	6.0-9.0	20

Table 3.3-2 provides a summary of all waters assessed (monitored and evaluated). Assessment coverage of rivers and streams was calculated at approximately 19,260 miles. At first glance, this appears to be a decrease from the previous reporting period. However, this apparent decrease is due to the geographical reindexing of the federal waterbody system and additional EPA and DEQ stream mile delineation guidance. The stream mile delineation guidance has provided consistent guidelines for associating the mileage assessed relative to a specific sampling station. This is especially important where there are no easily identifiable changes in watershed characteristics. In most cases, the stream miles associated with a sampling station have been conservatively reduced from previous assessment reports. Therefore, as a result, the total miles assessed have been reduced do to the fact that many sampling stations "associated" upstream and downstream mileage has been reduced . One other important aspect of the mileage delineation for this report has to do with the fact that the way the current mileages were calculated are only reflective of the assessment period from the last (1996) report and not the entire five year assessment period. In other words, the delineation method has changed since the 1996 report and the monitored mileages found in this report only reflect this current two year (1996-98) report cycle and should not be compared to the monitored mileages in previous reports.

Assessment of estuarine waters covered approximately 2,418 square miles of tidal estuaries. Coverage of coastal shore miles remained at 120 linear shore miles. An increased effort to assess the 104 most significant public lakes was accomplished. A total of 140,080 acres were assessed. Table 3.3-3 summarizes the assessments of Virginia's waters for support of aquatic life, fish consumption, shellfish, swimming and drinking water goals. Table 3.3-4 lists the causes and degree of impact for waters resulting in less than full support of the Clean Water Act goals and state water quality standards. All coastal shore waters were evaluated to be fully supporting the fishable and swimmable goals, therefore no causes of less than full support have been identified for these waters.

A major impact of causes and sources is defined as that which causes a significant impairment to the waterbody. Normally, a major impact would be from a sole source or a large contributor and would cause the waters to be not supporting. Moderate and minor impacts have a slight to moderate effect on the waters and may be from a single moderate contributor or a combination of several minor contributors and would generally cause the waters to be considered partially supporting.

As previously stated, the causes and sources of use impairment of Virginia's waters, resulting in less than full support of Clean Water Act goals, are summarized in Tables 3.3-4 and 3.3-5. It is apparent, municipal point sources and agricultural nonpoint sources are primary contributors of use impairment and major impacts. Equally apparent, the primary pollutants causing use impairment are low dissolved oxygen from nutrient enrichment and pathogen indicators. It is important to point out that the impaired waters affected by VDH fish consumption advisories for kepone in the lower James River and mercury in the South and North Fork Shenandoah River will not be included in the 303(d) impaired waters list for TMDL development. EPA and Virginia have agreed to take no additional remedial action for removing the contaminants from these waters. Dredging these waters to remove the contaminants is considered more environmentally damaging than allowing the natural degradation process diminish any potential health impacts.

Finally, another area of concern which is just beginning to be documented is the impact from urban runoff, especially storm sewer overflow drains. These nonpoint source impacts will need to be addressed as Total Maximum Daily Load (TMDL) allocations are developed for the impaired waters .

TABLE 3.3 - 2 - SUMMARY of ASSESSED WATERS

Degree of Use Support	Type	Assessment Category		Total Assessed Size
		Evaluated	Monitored	
Size Fully Supporting All Assessed Uses	E	39.34	583.17	622.51
	R	903.38	7683.87	8587.25
	L	1810.37	130,187.55	131997.92
Size Fully Supporting All Assessed Uses but Threatened for at Least One Use	E	0.08	1358.68	1358.76
	R	897.92	7164.03	8061.95
	L	0	77,342	77,342
Size Impaired for One or More Uses	E	1.83	435.00	436.83
	R	5.49	2605.18	2610.67
	L	0	0	0
Total Assessed	E	41.25	2376.85	2418.1
	R	1,806.79	17453.08	19259.87
	L	1,810.37	138,269.75	140,080.12

L = Lake - acres
E = Estuary - square miles
R = River - miles

TABLE 3.3 - 3 - WATERBODY INDIVIDUAL USE SUPPORT SUMMARY TABLE

Total Size Assessed:
Rivers - 19,260 miles
Lakes - 140,080 acres
Estuaries - 2,418 mi^2

Waterbody Size
Rivers - 49,358 miles
Lakes - 149,982 acres
Estuaries - 2,451 mi^2

Use	WaterBody Type	Size Fully Supporting	Size Fully Supporting but Threatened	TOTAL SIZE SUPPORTING	Size Partially Supporting	Size Not Supporting	TOTAL SIZE IMPAIRED	Size Not Assessed	TOTAL WATERBODY SIZE
Aquatic Life	River	8,736	10,455	**19191**	1021	394	**1415**	28752	**49,358**
	Lake	131,997	8,082	**140079**	0	0	**0**	9903	**149,982**
	Estuary	173	1965	**2138**	237	65	**302**	11	**2,451**
Fish Consumption	River	48,911	44	**48955**	189	80	**269**	134	**49,358**
	Lake	70,794	69,268	**140062**	0	0	**0**	9920	**149,982**
	Estuary	2,213	239	**2452**	0	0	**0**	-1	**2,451**
Shellfishing	River	*	*	**0**	*	*	**0**	49358	**49,358**
	Lake	*	*	**0**	*	*	**0**	149982	**149,982**
	Estuary	2,073	3	**2076**	116	24	**140**	235	**2,451**
Swimming	River	5,742	1,115	**6857**	876	559	**1435**	41066	**49,358**
	Lake	139,759	0	**139759**	0	0	**0**	10223	**149,982**
	Estuary	2,281	9	**2290**	16	3	**19**	142	**2,451**
Drinking Water	River	2,870	5	**2875**	5	0	**5**	46478	**49,358**
	Lake	103,245	0	**103245**	0	0	**0**	46737	**149,982**
	Estuary	2	*	**2**	*	*	**0**	2449	**2,451**
Administrative	River	0	8,995	**8995**	0	0	**0**	40363	**49,358**
(DCR/Nutrient Enriched)	Lake	0	0	**0**	0	0	**0**	149982	**149,982**

	Estuary	0	0	**0**	0	0	**0**	2451	**2,451**

*Categories not assessed

TABLE 3.3 - 4 SIZE OF WATERS IMPAIRED BY VARIOUS CAUSE CATEGORIES IN VIRGINIA

Pollutant	Type	Major Impact	Moderate/ Minor Impact
General Standards (Benthics)	River (mi) Lakes (acres) Estuary (mi^2)	55.86 0 0	254.50 0 1.21
Non Priority Organics	River (mi) Lakes (acres) Estuary (mi^2)	0 0 0	23.00 0 0
Priority Organics (TBT)	River (mi) Lakes (acres) Estuary (mi^2)	0 0 0	0 0 13.20
PCB	River (mi) Lakes (acres) Estuary (mi^2)	0 0 0	97.57 0 0
Metals	River (mi) Lakes (acres) Estuary (mi^2)	85.89 0 0	142.10 0 0.08
pH	River (mi) Lakes (acres) Estuary (mi^2)	222.52 0 0	193.87 0 5.23
Siltation	River (mi) Lakes (acres) Estuary (mi^2)	42.64 0 0	197.90 0 0
Organic Enrichment/Low D.O.	River (mi) Lakes (acres) Estuary (mi^2)	265.12 0 64.51	374.12 0 218.42
Thermal Modification	River (mi) Lakes (acres) Estuary (mi^2)	0 0 0	92.48 0 0
Pathogen Indicators	River (mi) Lakes (acres) Estuary (mi^2)	543.05 0 33.82	856.82 0 124.44
Habitat Alterations	River (mi) Lakes (acres) Estuary (mi^2)	0 0 0	77.16 0 0
Suspended Solids	River (mi) Lakes (acres) Estuary (mi^2)	1.70 0 0	0 0 0

TABLE 3.3 - 5 - SIZE OF WATERS IMPAIRED BY VARIOUS SOURCE CATEGORIES IN VIRGINIA

Source of Impairment	Type	Major Impact	Moderate/ Minor Impact
Industrial Point Sources	River (mi) Lakes (acres) Estuary (mi^2)	4.60 0 0.50	22.10 0 0
Municipal Point Sources	River (mi) Lakes (acres) Estuary (mi^2)	17.48 0 0.50	64.28 0 0
Combined Sewer Overflow	River (mi) Lakes (acres) Estuary (mi^2)	29.03 0 0	33.62 0 0
Collection System Failure	River (mi) Lakes (acres) Estuary (mi^2)	2.84 0 0	21.12 0 0
Agriculture	River (mi) Lakes (acres) Estuary (mi^2)	288.64 0 0	553.42 0 0.01
Grazing Related Sources	River (mi) Lakes (acres) Estuary (mi^2)	0 0 0	37.23 0 0
Silviculture	River (mi) Lakes (acres) Estuary (mi^2)	0 0 0	10.97 0 0
Urban Runoff/Storm Sewers	River (mi) Lakes (acres) Estuary (mi^2)	131.48 0 2.40	209.74 0 10.09
Resource Extraction	River (mi) Lakes (acres) Estuary (mi^2)	39.06 0 0	105.97 0 0
Land Disposal	River (mi) Lakes (acres) Estuary (mi^2)	71.50 0 0	23.75 0 0
Hydromodification	River (mi) Lakes (acres) Estuary (mi^2)	9.46 0 0	0 0 0
Debris/Bottom Deposits	River (mi) Lakes (acres) Estuary (mi^2)	0 0 0	1.00 0 0
Habitat Modification	River (mi) Lakes (acres) Estuary (mi^2)	7.28 0 0	18.35 0 0
Natural Sources	River (mi) Lakes (acres) Estuary (mi^2)	241.61 0 64.41	290.46 0 150.28
Source Unknown	River (mi)	117.98	441.33

Source of Impairment	Type	Major Impact	Moderate/ Minor Impact
	Lakes (acres)	0	0
	Estuary (mi^2)	0.58	5.13
VDH Shellfish Condemnation	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi^2)	23.75	116.10
Commercial Port Authority	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi^2)	0	13.20
Other Point Source/Nonpoint	River (mi)	0.74	32.30
	Lakes (acres)	0	0
	Estuary (mi^2)	0	0
VDH Fish Consumption Advisory	River (mi)	80.40	145.18
	Lakes (acres)	0	0
	Estuary (mi^2)	0	0

Chapter 3.4 NONPOINT SOURCE ASSESSMENT

This chapter of the Virginia Water Quality Assessment 305(b) Report provides a watershed assessment of nonpoint source (NPS) pollution potential. The NPS pollution watershed assessment was prepared by the Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation (DCR-DSWC). It provides a comparative evaluation of the state's waters, on a watershed basis, to assist in targeting NPS pollution protection activities. More specifically, it assesses NPS pollution potential on a watershed basis.

This NPS assessment summarizes information from the Virginia Department of Conservation and Recreation, Virginia Department of Environmental Quality, Virginia Department of Forestry (DOF), U.S. Department of Agriculture - Natural Resources Conservation Service, Cooperative Extension Service (CES), local Soil and Water Conservation Districts (SWCDs), local governments, and other existing sources of information concerning nonpoint source impacts to Virginia waters. As well, it includes information regarding rare, threatened, and endangered species provided by the Department of Conservation and Recreation, Division of Natural Heritage (DCR, DNH). This information will help program managers better target limited resources and funding.

Statewide Nonpoint Source Pollution Watershed Assessment Methodology

The nonpoint source pollution assessment was developed primarily from inventory data related to specific land use, animal density, and other related factors which have been developed in a uniform manner for all watersheds. This inventory data has been used to develop nonpoint source pollution priorities for the watersheds in Virginia. The following sections discuss and present inventory data and the methodology which was utilized to develop nonpoint source priorities within Virginia.

Inventory Data

Inventory data collected on a hydrologic unit basis were used to rank the watersheds for their potential for NPS pollution based on characteristics such as land use, animal densities and other related data. Data were collected to address the NPS potential from three major land use categories: agricultural, urban, and forestry.

Inventory data were initially collected at the county level from various sources, and then disaggregated to the watershed level. The following data sources were used to obtain county level inventory data: 1992 Census of Agriculture (U.S. Department of Commerce, 1989), 1990 National Survey of Conservation Tillage Practices (Conservation Technology Information Center, 1990), 1992 Natural Resources Inventory (Natural Resources Conservation Service), and the 1991 Hydrologic Unit Database (Department of Conservation and Recreation). Livestock and poultry inventories, land use, and erosion rates were estimated from the above mentioned sources.

To disaggregate the county data to individual watershed areas, questionnaires were created for each county to be completed by DCR, NRCS, SWCD, USDA Farm Service Agency (FSA), CES, DOF and other field personnel. Utilizing county level watershed maps, the field personnel distributed county-level information on land use, livestock and poultry inventories, and erosion rates amongst the watershed units. Adjustments to county level data based on local knowledge were also performed. The resulting level of detail allowed for grouping data for analysis and ranking by watershed unit as well as by jurisdiction. Table 3.4-1 shows the types of data which were collected for each watershed unit using the questionnaire.

Table 3.4-1 Data Collected by Watershed Using Questionnaire

A. Land use (areal extent in each category)

1. Cropland

I. Crop
ii. Hay
iii. Orchard
iv. Idle
v. NRCS Set-Aside
vi. Conservation Reserve Program

2. Pasture
3. Forest
4. Urban or built-up
I. Residential
ii. Industrial/commercial
iii. Other urban
5. Water

B. Livestock and Poultry (inventory)

1. Beef cattle
2. Milk cattle
3. Hogs/pigs
4. Sheep/lambs
5. Chickens
6. Broilers
7. Turkeys
8. Other (horses, fallow deer, etc.)

C. Erosion Information (areal extent in each category)

1. Crop
I. < T **
ii. T-2T
iii. > 2T
2. Pasture
I. < T
ii. T-2T
iii. > 2T

***** "T" refers to soil-loss tolerance or maximum allowable soil loss.

The Department of Conservation and Recreation, in conjunction with local units of government, also provided information concerning disturbed land for regulated erosion and sediment (E&S) control projects. This data was used to estimate sediment loads from urban development activities.

In addition, the Virginia Department of Forestry provided information on forestry harvesting and reforestation activities across the state. DOF estimates included data on acreages of forest harvesting, site preparation and reforestation. These data were used in conjunction with erosion rate data to estimate erosion from forest harvesting and site preparation. The results of this data are discussed later in this chapter.

A discussion of each aspect of the inventory data collected, the analysis performed, and statewide assessment of the data is discussed individually within the following sections.

Agriculture NPS Pollution Potential

Agriculture is a large and diverse industry in Virginia and accounts for approximately thirty

percent of Virginia's land use. While this percentage is significantly lower than the national average, agricultural activities constitute a significant source of nonpoint source pollution in the state.

Nonpoint source contamination from agriculture originates from several different sources with different associated impacts. The following sections provide a comparative statewide assessment and prioritization of three agriculturally related types of NPS contamination. These types of NPS contamination include: 1) nutrient loads from agricultural crop, pasture and hay lands; 2) nutrients from agriculturally produced animals; and, 3) erosion from agricultural cropland and pasture land. The statewide assessment and prioritization analyzes pollution potential from these types of agricultural activities. The 1998 assessment also takes into consideration NPS controls implemented through the Virginia Agricultural Best Management Practices Cost-Share Program and nutrient reductions that resulted from the Virginia Nutrient Management Program. These programs are administered by DCR. The inclusion of these NPS control activities in the assessment is a revision from the 1996 NPS Assessment.

Virginia's 1998 Agricultural Land Nutrient Load (AGLL) Priorities

AGLL priorities were developed using nutrients estimated from loading factors. Table 3.4-2 shows the nutrient loading factors applied to the land use acreage within each watershed. For each agricultural land use in the watershed, the acreage was multiplied by the corresponding loading factor to estimate yearly loads of nitrogen and phosphorus.

Table 3.4-2 Land Use Loading Factors

	Phosphorus kg/ha/yr (lb/ac/yr)	Nitrogen kg/ha/yr (lb/ac/yr)
1. Cropland		
crop	2.20 (1.96)	9.0 (8.0)
hay	0.85 (0.76)	5.0 (4.5)
orchard	0.75 (0.67)	2.5 (2.2)
idle land	0.75 (0.67)	2.5 (2.2)
FSA set-aside	0.75 (0.67)	2.5 (2.2)
CRP	0.75 (0.67)	2.5 (2.2)
2. Pasture	0.85 (0.76)	5.0 (4.5)
3. Forest	0.20 (0.18)	2.5 (2.2)
4. Urban or built-up		
residential	1.10 (0.98)	5.0 (4.5)
industrial/commercial	2.60 (2.32)	11.0 (9.0)
other urban	0.60 (0.54)	4.0 (3.6)
5. Water	0.00 (0.00)	0.0 (0.0)

Source: Beaulac and Reckhow (1982)

The nitrogen and phosphorus loads from the loading factors were summed to determine a yearly agricultural land nutrient load for each watershed. The per acre nutrient load was then calculated by dividing this nutrient load by the land area in each watershed. Finally, AGLL was computed for each watershed by normalizing the computed unit loads utilizing the average nutrient load value of all the watersheds and the standard deviation of the nutrient load values. This procedure was performed so that this indicator could be compared to normalized rankings for other pollution indicators.

Figure 3.4-1 displays the watersheds prioritized for agricultural land nutrient loadings.

Virginia's 1998 Animal Nutrient Load Priorities (AL)

AL priorities were developed using estimated nutrient loads produced by livestock and poultry. Nutrients produced each year by livestock and poultry were estimated by multiplying numbers of each animal type by an appropriate waste generation factor. The waste generation factors are based on average annual manure production and manure nutrient content for each animal type.

Table 3.4-3 shows the nutrient loading factors applied to the animal waste within each watershed.

Table 3.4-3 Animal Waste Loading Factors

	Phosphorus kg/yr/animal (lb/yr/animal)	**Nitrogen** kg/yr/animal (lb/yr/animal)
1. Beef cattle	15.11 (33.32)	84.81 (187.1)
2. Milk cattle	18.20 (40.15)	56.26 (124.1)
3. Hogs/pigs	(½) 0.81 (1.79)	2.40 (5.3)
	(½) 2.48 (5.48)	7.43 (16.4)
4. Sheep/lambs	1.09 (2.41)	7.43 (16.4)
5. Chickens	0.18 (0.40)	0.5 (1.1)
6. Broilers	0.09 (0.20)	0.41 (0.9)
7. Turkeys	0.44 (0.98)	1.99 (4.4)
8. Other		
horses	7.61 (16.79)	44.70 (98.6)
fallow deer	1.09 (2.41)	7.43 (16.4)

Source: Midwest Plan Service (1983) and American Society of Agricultural Engineers (1983)

Nitrogen and phosphorus estimates within each watershed were summed for all animals to determine an estimated yearly animal load. The unit load was then calculated by dividing this nutrient load by the land area in each watershed. Finally, AL was computed for each watershed by normalizing the computed unit loads utilizing the average animal nutrient load value of all watersheds and the standard deviation of the animal nutrient load values.

Figure 3.4-2 displays the animal nutrient load priorities by watershed statewide.

Virginia's 1998 Agricultural Erosion Priorities (AGER)

AGER priorities were evaluated using estimated erosion from agricultural land only. Potential annual erosion rates were estimated using erosion information from the questionnaires previously discussed and the Virginia 1982 National Resource Inventory (NRI) (NRCS, 1992). The questionnaires provided erosion information as amounts of cropland and pasture eroding at pre-defined ranges. These ranges were based on soil-loss tolerance or maximum allowable soil loss ("T" values). The acreage within each watershed was distributed amongst three erosion rate categories: less than "T", between "T" and "2T", and greater than "2T". Appropriate erosion rates were developed from the 1987 NRI based on the erosion ranges and acreage.

Estimated soil loss from the agricultural land categories was summed to estimate an agricultural erosion load for each hydrologic unit. A unit load was then calculated by dividing this erosion load by the land area in each watershed. Finally, the agricultural erosion load was normalized utilizing the average erosion rate for of all watersheds and the standard deviation of the erosion rates.

Figure 3.4-3 displays the watersheds with the priority areas for agricultural erosion potential.

Virginia's 1998 Total Agricultural NPS Pollution Priorities (AGTOT)

AGTOT priorities were computed for each watershed based on the three components discussed above. Agricultural land load (AGLL) assesses potential nutrients in runoff from crop, pasture, and hay land. Animal Nutrient Load Priorities (AL) account for nutrient contributions from livestock and poultry. Agricultural Erosion Priorities (AGER) ranks watersheds based on potential erosion occurring on agricultural land. The AGTOT for each watershed was computed as follows:

$$AGTOT_i = AGLL_i + AL_i + AGER_i$$

In the above equation, *I* represents the watershed of interest.

Figure 3.4-4 presents the total agricultural NPS pollution priorities statewide, which represents each watershed's relative significance in contributing to agricultural NPS pollution throughout the state. Watersheds with the higher priorities are the greatest priority for targeting agricultural conservation programs.

Urban NPS Pollution Potential

Urbanization of forest and agricultural land is occurring at a rapid rate in many parts of Virginia. This urbanization results in increased NPS pollution as the result of precipitation washing nutrients, sediment, and other toxic substances from the impervious surfaces which make up these areas. The sources of these surface contaminants include: air and rain deposition of atmospheric pollution; littered and dirty streets; traffic by-products such as petroleum residues, exhaust products, heavy metals and tar residuals from the roads; chemicals applied for fertilization, control of ice, rodents and other pests; and sediment from construction sites. Illegal industrial, commercial and domestic hook-ups to storm sewers also contribute a number of specific pollutants to water courses, as do inadequate sewage disposal systems both for municipalities and individual homes.

The following sections provide a comparative statewide assessment and prioritization of two urban related types of NPS pollution. These include nutrient loads from urban areas and erosion from urban lands and construction sites. The statewide assessment does not directly account for many of the other contaminants coming from urban lands; however, the weight of the urban priorities in the overall NPS pollution priorities has been increased in an attempt to compensate for these problems.

Virginia's 1998 Urban Nutrient Load Priorities (UNUT)

UNUT priorities were developed using nutrients estimated from loading factors. Table 3.4-2 shows the loading factors applied to the different urban land uses within each watershed. As previously stated, the acreage of each urban land use in the watershed was multiplied by the corresponding loading factor to estimate yearly loads of nitrogen and phosphorus available for NPS pollution.

The calculated nitrogen and phosphorus loads from loading factors were summed to determine a yearly urban nutrient load for each hydrologic unit. Unit loads were then calculated by dividing this nutrient load by the land area in each watershed. Finally, UNUT were computed for each watershed by normalizing the computed unit loads utilizing the average nutrient load value of all watersheds and the standard deviation of the nutrient load values. This procedure was performed so that the two urban indices would be comparable in value.

Figure 3.4-5 displays the watersheds statewide for urban land nutrient loading priorities. The priorities generally identify the major urban areas within Virginia and reflect the general urbanized area

of Tidewater Virginia as compared to the remainder of the state.

Virginia's 1998 Urban Erosion Priorities (UERO)

UERO priorities were developed by estimating urban erosion rates from disturbed and undisturbed urban lands. Disturbed urban areas were estimated by DCR erosion and sediment control field personnel in consultation with local government staff for each watershed by estimating the amount of urban land which was disturbed. This estimate is based primarily on land which is under development and regulated by the Virginia Erosion and Sediment Control Law (Title 10.1, Chapter 5, Article 4, Section 10.1-560 of the Code of Virginia). All other urban lands identified within the watershed were considered undisturbed. An erosion rate of 45 tons/acre was then utilized for disturbed land and .6 tons/acre for undisturbed land. An Urban erosion load was then calculated for each watershed by summing the calculated urban soil loss loads for disturbed and undisturbed land and then dividing this total load by the land area within each watershed to get the unit load for each watershed. The unit loads were then normalized utilizing the average urban erosion rate of all watersheds and the standard deviation of the erosion rates.

Figure 3.4-6 displays the watershed priorities for urban erosion statewide. The priorities are reflective of the areas of Virginia which are undergoing the most significant urban development activity. It is important to keep in mind that these priorities are based on pollution potential and do not compensate for control measures that may be in place in some areas.

Virginia's 1998 Total Urban Pollution NPS Priorities (UTOT)

UTOT priorities are indicated on Figure 3.4-7. These priorities reflect the relative potential significance of each watershed in contributing to urban NPS pollution on a comparative statewide basis. The total urban pollution priority was developed for each watershed based on two components: the urban land nutrient priorities and the urban erosion priorities. The erosion portion of these priorities includes separate erosion estimates for disturbed and undisturbed urban land.

Figure 3.4-7 indicates, as expected, that the highest priority urban areas are those portions of the state already containing substantial developed areas or that are currently urbanizing.

Forestry Nonpoint Source Pollution Priorities

The Virginia Department of Forestry (DOF) has begun tracking numerous activities of the forest industry to facilitate the proper management of Virginia's forest resources relative to water quality. Among these activities are the recording of forest harvesting, site preparation, and reforestation acres on a watershed and county basis. This information, in conjunction with other scientific data, provides a management tool for targeting and evaluating the NPS pollution potential on a statewide basis and serves as the principal component of the forestry NPS assessment information.

The following maps and analysis attempt to quantify soil erosion from timber harvesting and site preparation activities. These activities may contribute to increases in sedimentation of the state's water courses and potential physical and biological impacts if proper management does not occur. Data on forestry activities were developed by DOF foresters. The maps depict the relative level of forest activity on a per acre basis of land within each hydrologic unit for the calendar year 1994 and are reflective of that year's activity only. The analysis and maps make no attempt to account for proper management, or lack thereof, and reflect only the potential for forestry related nonpoint source concerns.

Virginia's 1998 Forestry Harvested Erosion Priorities (FHAR)

FHAR priorities were calculated for each watershed by multiplying the total acres harvested during 1994 by the logging erosion rates for Major Land Resource Areas (MLRAs). MLRAs erosion

rates are listed in Table 3.4-4. The per unit value was then calculated by dividing the result by the total acreage of the watershed. Figure 3.4-8 displays the statewide watershed priorities for forest harvesting activities.

Virginia's 1998 Forestry Site-Prepared Erosion Priorities (FSIT)

FSIT priorities were calculated for each watershed by multiplying the sum of site-prepared acres during 1994 by erosion rates reported in Table 3.4-4 for the MLRAs. A per unit value was then calculated by dividing the result by the total land acreage of the watershed. The priority watersheds for site preparation activities are shown in Figure 3.4-9.

Virginia's 1998 Total Forestry Erosion Priorities (FTOT)

FTOT priorities were calculated by adding the estimates of soil loss due to harvesting and site prepared activities within each watershed. These estimates are added since these forestry operations are separate and distinct. The per unit value was then calculated by dividing the result by the total land acreage of the watershed. The total forestry rankings are depicted in Figure 3.4-10.

The forestry rankings are affected principally by the number of acres subject to a specific forest activity and the erosion rates assigned to the region. In general, more forest harvesting and site preparation occurs in Virginia's Piedmont and coastal areas. However, erosion rates for these areas are much lower than the rates recorded for western portions of the state. The higher western rates tend to cause the rating of forestry areas in the west to be higher than areas in the east with similar activity levels. This pattern is consistent with other non-forestry activities, such as agriculture, and is due largely to topography and the variation of soil types.

It should be noted that only a fraction of all sedimentation in Virginia is caused by timber related activities, and its duration is usually only two or three years following harvest. Most logging related erosion is restricted to either roads and trails used to remove logs from the forest or to land that is being prepared for reforestation.

Table 3.4-4 Erosion Rates on Forest Lands

Forest Activity					
MLRA	Logging	Only Burn	Chop/Burn	Bull-Dozing	Chemical
Erosion Rates (lbs./ac./yr.)					
125	0.43	3.6	0.14*	13.7*	0
128	1.75	3.6*	0.14*	13.7	0
130	3.68	3.6*	0.14*	13.7*	0
136	0.48	0.16	0.38	1.9	0
147	1.75•	3.6*	0.14*	13.7*	0
148	0.13	3.6*	0.14	13.7*	0
133A	0.45	0.15	0.36	0.78	0
153A	0.08	0.10	0.15	0.78	0
153B	0.08	0.10	0.15	0.78	0

•No data was reported for MLRA 147; assumed similar to MLRA 128.
*No data was reported. Values assumed based on guidance from Virginia Department of Forestry.
Source: Dissmeyer and Stump, 1978

Virginia's 1998 Overall Nonpoint Source Pollution Priorities

The overall nonpoint source pollution priorities are based on a weighted combination of the total priority results from the agriculture, urban and forestal sources. As discussed within the forestry section above, the relative contribution of forestry sources is considered much less significant than agriculture or urban sources due to the relative potential for nutrient and sediment loading from forestal activities as compared to these other sources. Therefore, the total NPS priority rating weights the forestal source at 5% and the urban and agricultural sources are equally weighted at 47.5% to determine the overall rating value for each watershed. Based on this weighting, Figure 3.4-11 illustrates the overall NPS priority watersheds broken into three categories of high, medium and low. The high priority watersheds reflect the top 20% of the rated watersheds, with the next 30% considered medium priority and the remaining 50% considered low priority. This breakdown of high, medium and low priority watersheds is consistent with Environmental Protection Agency (EPA) recommendations to identify the top 20% of watersheds as high priority. In addition, watersheds in which special projects have been initiated with funds from Section 319 of the Clean Water Act will remain high priority until water quality monitoring as funded through those projects indicates a water quality improvement. This process resulted in 111 high, 140 medium and 243 low priority watersheds.

In general, NPS priorities reflect Virginia's urban and agricultural dominated regions. In particular, the priorities highlight the urbanizing eastern crescent from Northern Virginia to the Hampton Roads area along with other urban centers such as Roanoke and Lynchburg. Agricultural influences due to cropland nutrient use on the Eastern Shore, intensive animal and other associated agricultural activity in the Shenandoah Valley area, and high erosion rates in Southwestern portions of the state are also key factors in the overall prioritization.

These results of the overall priority ranking process are summarized in Table 3.4-5 which list watersheds in alphabetical order within a high, medium, or low priority ranking. Table 3.4-5 also includes a priority ranking of watersheds based on known occurences of natural heritage resources.

Natural Heritage Resource data was included in the overall priority ranking so that information regarding rare, threatened, and endangered species could be easily cross referenced with overall pollution potential priorities to help determine the relative importance of a given watershed and the need for restoration or protection. The methodology used in determining the watershed priority ranking for natural heritage resources is discussed in a subsequent section of this report.

As discussed, the overall 1998 nonpoint source pollution priorities are influenced mostly by the agricultural and urban information obtained from across the state. The overall rank excludes abandoned mined land data and septic system data, which may have a very important effect on water quality problems on a local or regional basis. For purposes of this report, we have not been able to consolidate available information to characterize these pollution sources by watershed. Efforts are continuing to assess impacts due to these sources.

Many other data sources could be used to further determine the importance of a watershed and the need for protection. Information such as public water supply locations or other specific use requirements of water resources should be incorporated where possible. Thus far, these data have not been used in the statewide rankings.

Natural Heritage Resources Priority Ranking Methodology

For purposes of this report, hydrologic units have been ranked according to the presence of wetland and aquatic natural heritage resources. Natural heritage resources include the habitat of rare, threatened, and endangered plant and animal species and exemplary natural communities. DCR's Division of Natural Heritage (DCR-DNH), responsible for identifying and inventorying Virginia's natural heritage resources, has documented over 7800 occurrences of approximately 1400 rare plants and animals and 220 natural community types. Information about the status and location of these occurrences is used to prioritize and direct conservation activities, and to guide economic

development activities that might impact these resources.

Much of the Commonwealth's biodiversity is directly dependent on the water quality of rivers, streams, wetlands, and groundwater. Virginia's hydrologic units have been prioritized according to their importance for natural heritage resources. These priorities should direct nonpoint source contamination mitigation efforts and other water quality improvement projects toward those watersheds in which natural heritage resources will benefit from the maintenance or enhancement of water quality.

The following procedure was followed to rank the hydrologic units for their significance to natural heritage resources.

- Only natural heritage resources likely to be directly impacted by changes in water quality were included in the assessment. These include aquatic and wetland plants and animals, wetland communities, and subterranean aquatic invertebrates. About 915 species and 34 natural communities are included.

- Natural heritage resource occurrences that have been verified since 1970 and whose locations are known to an accuracy of within 1.5 miles on a 7.5 minute USGS quadrangle are included. The total number of natural heritage resource occurrences considered is 3294, including 245 natural community occurrences. These occurrences are located in 319 of Virginia's 494 hydrologic units.

- A formula was used to assign a score to each hydrologic unit. The factors used to determine this score were the number of natural heritage resource occurrences in the hydrologic unit and the global rarity (Grank) of these natural heritage resources, as established by the Network of National Heritage Programs and Conservation Data Centers. Weighted values were assigned to the global rarity rank of each natural heritage resource according to table 3.4-5.

Table 3.4-5 Global Rarity Ranking

Global Rarity Rank	WEIGHT
G1 (extremely rare and critically imperilled)	10
G2 (very rare and imperilled)	7
G3 (either very rare throughout its range or found in a restricted range)	4
G4 (common and apparently secure globally, though rare in Virginia)	2
G5 (very common and secure globally, though rare in Virginia)	1

These values were then summed for each natural heritage resource occurrence in a hydrologic unit to calculate a final score for the watershed. Scores ranged from 0 (175 hydrologic units with no documented occurrences) to 857 (one hydrologic unit with 156 occurrences).

- The scores were used to aggregate the hydrologic units into three priority classes: high, medium and low priority. A complete listing of natural heritage resource priorities for every hydrologic unit in Virginia is found in Table 3.4-6. Natural heritage resource priorities are also represented on a map of Virginia, Figure 3.4-12. The following table shows the distribution of priorities:

Table 3.4-6 Hydrologic Unit Scoring

PRIORITY	WATERSHED SCORES	NO. OF HYDROLOGIC UNITS

High	31 +	99 (20%)
Medium	6-30	146 (30%)
Low	0-5	249 (50%)

The lack of documented natural heritage resource occurrences does not guarantee that natural heritage resources are not present, because many watersheds have not been adequately inventoried. Consequently a low priority ranking does not necessarily mean that there are no natural heritage resources present in a given watershed. Rather, it could mean that no resources have been recorded because the watershed has not been adequately surveyed. In otherwords, a low priority ranking could be the result of no data. Information in DCR-DNH's databases is continually added and updated. Project planners are encouraged to contact DCR-DNH for current and detailed information on the status of natural heritage resource occurrences. Table 3.4-7 provides the statewide priority ranking for the Natural Heritage priority ranking and nonpoint source pollution potential priorities

Table 3.4-7 Statewide Nonpoint Source Pollution Potential Priorities with Natural Heritage Priority Ranking

Watershed ID	Watershed Name	NPS Ranking	Natural Heritage Ranking
A02	CATOCTIN CREEK	High	Low
A03	POTOMAC RIVER/LIMESTONE BRANCH	High	Low
A06	NORTH FORK GOOSE CREEK	High	Medium
A09	POTOMAC RIVER/BROAD RUN	High	Low
A10	SUGARLAND RUN	High	Low
A11	POTOMAC RIVER/DIFFICULT RUN	High	High
A12	POTOMAC RIVER/FOURMILE RUN/PIMMIT RUN	High	Low
A13	CAMERON RUN	High	Low
A14	POTOMAC RIVER/DOGUE CREEK/LITTLE HUNTING CREEK	High	Medium
A15	ACCOTINK CREEK	High	Medium
A16	POHICK CREEK	High	Low
A20	UPPER OCCOQUAN RIVER/LAKE JACKSON	High	Low
A21	UPPER BULL RUN/LITTLE BULL RUN	High	Low
A22	CUB RUN	High	Low
A23	LOWER BULL RUN/POPES HEAD CREEK	High	Low
A24	OCCOQUAN RIVER - RESERVOIR	High	Low
A25	POTOMAC RIVER/LOWER OCCOQUAN RIVER/NEABSCO CREEK	High	Medium
A26	POTOMAC RIVER/QUANTICO CREEK/CHOPAWAMSIC CREEK	High	Medium
A27	UPPER AQUIA CREEK/BEAVERDAM RUN	High	Medium
A28	LOWER AQUIA CREEK	High	Low
B01	UPPER NORTH FORK SOUTH BRANCH POTOMAC RIVER/LAUREL	High	High
B10	UPPER MIDDLE RIVER	High	Low
B12	MIDDLE RIVER/LEWIS CREEK	High	Low
B13	MOFFETT CREEK	High	Low
B14	CHRISTIANS CREEK	High	Medium

Watershed ID	Watershed Name	NPS Ranking	Natural Heritage Ranking
B15	LOWER MIDDLE RIVER	High	Low
B17	MIDDLE NORTH RIVER	High	Low
B18	BRIERY BRANCH	High	Medium
B19	MOSSY CREEK	High	Low
B21	LOWER DRY RIVER	High	Low
B22	MUDDY CREEK	High	Low
B23	LOWER NORTH RIVER	High	Low
B24	LONG GLADE CREEK	High	Low
B25	COOKS CREEK	High	Low
B26	BLACKS RUN	High	Low
B27	PLEASANT RUN	High	Low
B28	NAKED CREEK	High	Low
B29	MILL CREEK	High	Low
B30	UPPER SOUTH RIVER	High	High
B34	CUB RUN	High	Low
B41	LOWER SOUTH FORK SHENANDOAH RIVER	High	Medium
B45	NORTH FORK SHENANDOAH RIVER/HOLMANS CREEK	High	Low
B46	LINVILLE CREEK	High	Medium
B55	UPPER SHENANDOAH RIVER	High	Low
B57	SHENANDOAH RIVER/SPOUT RUN	High	Medium
C03	PIANKATANK RIVER	High	Medium
C06	CHESAPEAKE BAY/SEVERN RIVER	High	Medium
C07	CHESAPEAKE BAY/BACK RIVER/POQUOSON RIVER	High	High
C08	LYNNHAVEN RIVER/LITTLE CREEK	High	High
C15	CHERRYSTONE INLET/KINGS CREEK	High	Medium
C16	CHESAPEAKE BAY/OLD PLANTATION CREEK	High	Medium
D01	CHINCOTEAGUE BAY/LITTLE MOSQUITO CREEK	High	High
D05	OUTLET BAY/RAMSHORN BAY	High	High
D07	RUDEE INLET	High	Medium
E09	MOUNTAIN RUN	High	Medium
E16	RAPIDAN RIVER/CEDAR RUN	High	Medium
F20	RAPPAHANNOCK RIVER/MASSAPONAX CREEK	High	Low
F23	RAPPAHANNOCK RIVER/CATPOINT CREEK/PISCATAWAY CREEK	High	High
F20	POLECAT CREEK	High	Medium
F27	LOWER YORK RIVER/CARTER CREEK/KING CREEK	High	High
G01	JAMES RIVER/FALLING CREEK/PROCTORS CREEK	High	Medium

Watershed ID	Watershed Name	NPS Ranking	Natural Heritage Ranking
G05	UPPER CHICKAHOMINY RIVER/UPHAM BROOK/STONY RUN	High	Low
G10	JAMES RIVER/POWHATAN CREEK/GRAYS CREEK	High	High
G11	JAMES RIVER/PAGEN RIVER/WARWICK RIVER/CHUCKATUCK	High	High
G15	HAMPTON ROADS/ELIZABETH RIVER	High	Medium
H03	JAMES RIVER/BLACKWATER CREEK/IVY CREEK	High	Low
H28	UPPER RIVANNA RIVER/MOORES CREEK	High	Low
H29	MIDDLE RIVANNA RIVER/BUCK ISLAND CREEK	High	Low
H39	JAMES RIVER/TUCKAHOE CREEK/NORWOOD CREEK	High	Medium
I04	JACKSON RIVER/FALLING SPRING CREEK	High	Medium
I18	UPPER JAMES RIVER/SINKING CREEK/MILL CREEK	High	Low
I20	MEADOW CREEK	High	Medium
I33	UPPER MAURY RIVER/KERRS CREEK	High	Medium
I34	HAYS CREEK	High	Low
I35	MIDDLE MAURY RIVER/MILL CREEK	High	Low
J15	LOWER APPOMATTOX RIVER/ASHTON CREEK	High	High
K30	LOWER NOTTOWAY RIVER/MILL CREEK	High	Medium
K40	NORTHWEST RIVER	High	High
L04	ROANOKE RIVER/MASON CREEK	High	Medium
L05	TINKER CREEK/CARVIN CREEK/GLADE CREEK	High	Medium
L09	MAGGODEE CREEK	High	Low
L12	LOWER SMITH MOUNTAIN LAKE	High	Low
L26	LITTLE OTTER RIVER/MACHINE CREEK	High	Medium
L49	MATRIMONY CREEK	High	Low
L53	SMITH RIVER/REED CREEK/BEAVER CREEK	High	Low
L54	LOWER SMITH RIVER	High	Low
L58	SANDY RIVER	High	Low
L60	DAN RIVER/CANE CREEK	High	Low
L61	FALL CREEK	High	Low
N05	ELK CREEK	High	Low
N06	NEW RIVER/CHESTNUT CREEK/BRUSH CREEK	High	High
N09	CRIPPLE CREEK	High	Medium
N10	UPPER REED CREEK	High	Low
N13	UPPER BIG REED ISLAND CREEK/LAUREL FORK	High	High
N18	NEW RIVER/CRAB CREEK	High	Medium
N19	EAST FORK LITTLE RIVER	High	High
N21	LITTLE RIVER/INDIAN CREEK/BRUSH CREEK	High	Low

Watershed ID	Watershed Name	NPS Ranking	Natural Heritage Ranking
O05	LOWER MIDDLE FORK HOLSTON RIVER	High	High
O06	SOUTH HOLSTON LAKE/WOLF CREEK/FIFTEENMILE CREEK	High	Medium
O07	SOUTH FORK HOLSTON RIVER/BEAVER CREEK	High	Low
O10	NORTH FORK HOLSTON RIVER/LAUREL CREEK	High	High
O11	NORTH FORK HOLSTON RIVER/WOLF CREEK/TUMBLING CREEK	High	High
O13	LOWER NORTH FORK HOLSTON RIVER/POSSUM CREEK	High	High
O14	BIG MOCCASIN CREEK	High	Medium
P01	UPPER CLINCH RIVER	High	Medium
P05	LITTLE RIVER	High	High
P06	BIG CEDAR CREEK	High	Medium
P07	CLINCH RIVER/THOMPSON CREEK	High	High
P14	COPPER CREEK	High	High
P20	NORTH FORK POWELL RIVER	High	Low
O13	POUND RIVER	High	Medium
A01	POTOMAC RIVER/PINEY RUN/DUTCHMAN CREEK	Medium	Medium
A04	UPPER GOOSE CREEK/GAP RUN	Medium	Medium
A05	MIDDLE GOOSE CREEK/PANTHER SKIN CREEK	Medium	Medium
A07	BEAVERDAM CREEK	Medium	Low
A08	LOWER GOOSE CREEK/LITTLE RIVER	Medium	Medium
A17	UPPER CEDAR RUN/LICKING RUN	Medium	Low
A19	BROAD RUN/KETTLE RUN	Medium	Medium
A29	POTOMAC RIVER/POTOMAC CREEK	Medium	Medium
A30	POTOMAC RIVER/UPPER MACHODOC CREEK	Medium	Medium
A31	POTOMAC RIVER/MATTOX CREEK/POPES CREEK/ROSIER CREEK	Medium	Medium
A32	POTOMAC RIVER/NOMINI CREEK/LOWER MACHODOC CREEK	Medium	Medium
A34	POTOMAC RIVER/COAN RIVER/LITTLE WICOMICO RIVER	Medium	High
B02	UPPER SOUTH BRANCH POTOMAC RIVER	Medium	Low
B08	UPPER OPEQUON CREEK	Medium	Low
B09	LOWER OPEQUON CREEK	Medium	Medium
B11	MIDDLE RIVER/JENNINGS BRANCH	Medium	Low
B32	LOWER SOUTH RIVER	Medium	High
B40	SOUTH FORK SHENANDOAH RIVER/GOONEY RUN	Medium	Medium
B47	SMITH CREEK	Medium	Medium
B48	NORTH FORK SHENANDOAH RIVER/MILL CREEK	Medium	Low
B49	STONY CREEK	Medium	Low
B50	NORTH FORK SHENANDOAH RIVER/NARROW PASSAGE CREEK	Medium	Medium

Watershed ID	Watershed Name	NPS Ranking	Natural Heritage Ranking
B53	LOWER CEDAR CREEK	Medium	Low
B56	CROOKED RUN	Medium	Low
C01	CHESAPEAKE BAY/GREAT WICOMICO RIVER	Medium	Low
C04	CHESAPEAKE BAY/EAST RIVER/NORTH RIVER	Medium	High
C05	WARE RIVER	Medium	Low
C09	POCOMOKE RIVER/PITTS CREEK	Medium	Low
C11	CHESAPEAKE BAY/ONANCOCK CREEK	Medium	Medium
C12	PUNGOTEAGUE CREEK	Medium	Low
C13	NANDUA CREEK/OCCOHANNOCK CREEK/NASSAWADOX CREEK	Medium	High
C14	CHESAPEAKE BAY/HUNGARS CREEK	Medium	Medium
D02	ASSAWOMAN CREEK	Medium	Medium
D03	METOMKIN BAY/BURTONS BAY	Medium	High
D04	HOG ISLAND BAY/MACHIPONGO RIVER	Medium	High
D06	MAGOTHY BAY/MOCKHORN BAY	Medium	High
E01	UPPER RAPPAHANNOCK RIVER/THUMB RUN/JORDAN RIVER	Medium	Medium
E02	RAPPAHANNOCK RIVER/CARTER RUN/GREAT RUN	Medium	High
E06	LOWER THORNTON RIVER	Medium	Low
E07	LOWER HAZEL RIVER/MUDDY RUN/INDIAN RUN	Medium	Low
E08	RAPPAHANNOCK RIVER/MARSH RUN	Medium	Medium
E13	RAPIDAN RIVER/BLUE RUN/BEAUTIFUL RUN	Medium	Medium
E14	UPPER ROBINSON RIVER/WHITE OAK RUN	Medium	High
E15	LOWER ROBINSON RIVER/CROOKED RUN/DEEP RUN	Medium	Low
E17	RAPIDAN RIVER/MINE RUN/MOUNTAIN RUN	Medium	Low
E19	RAPPAHANNOCK RIVER/MOTTS RUN	Medium	Low
E22	RAPPAHANNOCK RIVER/OCCUPACIA CREEK/PEEDEE CREEK	Medium	High
E24	RAPPAHANNOCK RIVER/TOTUSKEY CREEK	Medium	Medium
E26	LOWER RAPPAHANNOCK RIVER/CORROTOMAN RIVER	Medium	High
F01	UPPER SOUTH ANNA RIVER	Medium	Low
F04	LOWER SOUTH ANNA RIVER	Medium	High
F08	CONTRARY CREEK	Medium	Low
F11	LOWER LITTLE RIVER	Medium	Low
F12	UPPER PAMUNKEY RIVER/MECHUMPS CREEK	Medium	Low
F13	MIDDLE PAMUNKEY RIVER/BLACK CREEK/TOTOPOTOMOY CREEK	Medium	Low
F15	NI RIVER	Medium	Low
F19	SOUTH RIVER	Medium	Medium
F26	UPPER YORK RIVER/POROPOTANK RIVER/QUEEN CREEK/WARE	Medium	High

Watershed ID	Watershed Name	NPS Ranking	Natural Heritage Ranking
G02	JAMES RIVER/TURKEY ISLAND CREEK/FOURMILE CREEK	Medium	Low
G03	JAMES RIVER/POWELL CREEK/WEST RUN/BAILEY CREEK	Medium	High
G06	CHICKAHOMINY RIVER/WHITE OAK SWAMP/BEAVERDAM CREEK	Medium	High
G07	CHICKAHOMINY RIVER/RUMLEY MARSH	Medium	Medium
G08	LOWER CHICKAHOMINY RIVER/MORRIS CREEK/LOWER	Medium	High
G12	SPEIGHTS RUN/LAKE COHOON/LAKE MEADE/LAKE KILBY	Medium	Medium
G13	NANSEMOND RIVER/BENNETT CREEK	Medium	Medium
H04	HARRIS CREEK	Medium	Low
H05	JAMES RIVER/BEAVER CREEK/BECK CREEK	Medium	Low
H09	UPPER TYE RIVER	Medium	Medium
H18	NORTH FORK HARDWARE RIVER/SOUTH FORK HARDWARE RIVER	Medium	Low
H23	MECHUMS RIVER	Medium	High
H26	SOUTH FORK RIVANNA RIVER/IVY CREEK	Medium	Low
H31	LOWER RIVANNA RIVER/BALLINGER CREEK	Medium	Medium
H38	JAMES RIVER/BEAVERDAM CREEK/FINE CREEK	Medium	Medium
I01	UPPER JACKSON RIVER	Medium	Medium
I09	LOWER JACKSON RIVER/WILSON CREEK/KARNES CREEK	Medium	Medium
I15	STUART RUN	Medium	Low
I25	CATAWBA CREEK	Medium	Medium
I26	LOONEY CREEK/MILL CREEK	Medium	Low
I28	JAMES RIVER/ELK CREEK/CEDAR CREEK	Medium	Medium
I37	LOWER MAURY RIVER/POAGUE RUN	Medium	Medium
I38	BUFFALO CREEK	Medium	Low
J07	APPOMATTOX RIVER/SKINQUARTER CREEK/ROCKY FORD CREEK	Medium	Low
J16	UPPER SWIFT CREEK/SWIFT CREEK RESERVOIR	Medium	Low
J17	LOWER SWIFT CREEK	Medium	High
K05	MEHERRIN RIVER/GENITO CREEK/ALLEN CREEK	Medium	Low
K07	ROSES CREEK	Medium	Low
K09	MEHERRIN RIVER/FALLING RUN	Medium	High
K12	LOWER FONTAINE CREEK/MILL SWAMP	Medium	Medium
K13	LOWER MEHERRIN RIVER/TARRARA CREEK/FLAT SWAMP	Medium	Medium
K16	NOTTOWAY RIVER/TOMMEHETON CREEK/CROOKED CREEK	Medium	High
K28	NOTTOWAY RIVER/MILL SWAMP/NOTTOWAY SWAMP	Medium	Medium
K31	BLACKWATER SWAMP/WARWICK SWAMP	Medium	Medium
K41	NORTH LANDING RIVER	Medium	High
K42	BACK BAY	Medium	High

Watershed ID	Watershed Name	NPS Ranking	Natural Heritage Ranking
L03	UPPER ROANOKE RIVER	Medium	High
L06	BACK CREEK	Medium	
L07	ROANOKE RIVER/SMITH MOUNTAIN LAKE/BEAVERDAM CREEK	Medium	
L25	BIG OTTER RIVER/ELK CREEK	Medium	Medium
L27	BIG OTTER RIVER/BUFFALO CREEK	Medium	Low
L29	FLAT CREEK	Medium	Low
L56	LEATHERWOOD CREEK	Medium	Low
L57	DAN RIVER/CASCADE CREEK	Medium	Low
L59	SANDY CREEK (WEST)	Medium	Low
L64	DAN RIVER/LAWSONS CREEK/MIRY CREEK	Medium	Low
L69	STINKING RIVER	Medium	Low
L71	LOWER BANISTER RIVER/POLECAT CREEK	Medium	Low
L75	JOHN KERR RESERVOIR/BUTCHER CREEK	Medium	Medium
L78	LAKE GASTON/ALLEN CREEK/COX CREEK	Medium	Low
L79	LAKE GASTON/MILES CREEK/FLAT CREEK/SMITH CREEK	Medium	Low
M03	UPPER ARARAT RIVER	Medium	Medium
N01	HELTON CREEK/BIG HORSE CREEK	Medium	Medium
N02	UPPER NEW RIVER/WILSON CREEK	Medium	High
N03	FOX CREEK	Medium	Medium
N04	NEW RIVER/PEACH BOTTOM CREEK/LITTLE RIVER	Medium	Medium
N07	CROOKED CREEK	Medium	High
N08	NEW RIVER/SHORTS CREEK/PINE RUN	Medium	Low
N11	LOWER REED CREEK	Medium	Medium
N12	COVE CREEK	Medium	Low
N14	LOWER BIG REED ISLAND CREEK/GREASY CREEK/BURKS FORK	Medium	High
N15	LITTLE REED ISLAND CREEK	Medium	Medium
N20	WEST FORK LITTLE RIVER	Medium	High
N23	NEW RIVER/SINKING CREEK	Medium	Medium
N24	NEW RIVER/LITTLE STONY CREEK	Medium	High
N25	WALKER CREEK	Medium	Medium
N30	UPPER WOLF CREEK	Medium	Low
O01	UPPER SOUTH FORK HOLSTON RIVER	Medium	Low
O02	SOUTH FORK HOLSTON RIVER/WHITETOP LAUREL CREEK	Medium	High
O04	MIDDLE FORK HOLSTON RIVER/HUNGRY MOTHER CREEK	Medium	High
O08	REEDY CREEK	Medium	Low
O09	UPPER NORTH FORK HOLSTON RIVER	Medium	Medium

Watershed ID	Watershed Name	NPS Ranking	Natural Heritage Ranking
O12	NORTH FORK HOLSTON RIVER/ABRAMS CREEK	Medium	High
P03	CLINCH RIVER/MIDDLE CREEK	Medium	High
P04	CLINCH RIVER/SWORDS CREEK/LEWIS CREEK	Medium	High
P09	CLINCH RIVER/LITTLE STONY CREEK	Medium	High
P11	GUEST RIVER	Medium	Medium
P13	CLINCH RIVER/STOCK CREEK/COVE CREEK	Medium	High
P15	NORTH FORK CLINCH RIVER	Medium	Low
P17	UPPER POWELL RIVER/CALLAHAN CREEK/ROARING FORK	Medium	Low
A18	LOWER CEDAR RUN/TOWN RUN	Low	Low
A33	POTOMAC RIVER/YEOCOMICO RIVER	Low	Medium
B03	UPPER SOUTH FORK SOUTH BRANCH POTOMAC RIVER	Low	Low
B04	SLEEPY CREEK	Low	Low
B05	UPPER BACK CREEK/ISAACS CREEK	Low	Low
B06	HOGUE CREEK	Low	Low
B07	LOWER BACK CREEK/BRUSH CREEK/BABBS RUN	Low	Medium
B16	UPPER NORTH RIVER	Low	Low
B20	UPPER DRY RIVER	Low	Medium
B31	MIDDLE SOUTH RIVER/BACK CREEK	Low	High
B33	UPPER SOUTH FORK SHENANDOAH RIVER	Low	High
B35	SOUTH FORK SHENANDOAH RIVER/ELK RUN/BOONE RUN	Low	Low
B36	NAKED CREEK	Low	Medium
B37	SOUTH FORK SHENANDOAH RIVER/CUB RUN	Low	Low
B38	SOUTH FORK SHENANDOAH RIVER/MILL CREEK	Low	Low
B39	HAWKSBILL CREEK	Low	Medium
B42	UPPER NORTH FORK SHENANDOAH RIVER/GERMAN RIVER	Low	Low
B43	NORTH FORK SHENANDOAH RIVER/LITTLE DRY RIVER	Low	Low
B44	NORTH FORK SHENANDOAH RIVER/SHOEMAKER RIVER	Low	Medium
B51	LOWER NORTH FORK SHENANDOAH RIVER/TUMBLING RUN	Low	Medium
B52	UPPER CEDAR CREEK	Low	Medium
B54	PASSAGE CREEK	Low	Medium
B58	LOWER SHENANDOAH RIVER	Low	High
C02	DRAGON SWAMP	Low	High
C10	CHESAPEAKE BAY/HOLDENS CREEK	Low	High
E03	HUGHES RIVER	Low	Low
E04	UPPER HAZEL RIVER	Low	Low
E05	UPPER THORNTON RIVER	Low	Low

Watershed ID	Watershed Name	NPS Ranking	Natural Heritage Ranking
E10	RAPPAHANNOCK RIVER/DEEP RUN/ROCK RUN	Low	Low
E11	UPPER RAPIDAN RIVER/CONWAY RIVER	Low	Medium
E12	RAPIDAN RIVER/SOUTH RIVER	Low	Medium
E18	LOWER RAPIDAN RIVER	Low	Medium
E21	RAPPAHANNOCK RIVER/MILL CREEK/GOLDENVALE CREEK	Low	High
E25	RAPPAHANNOCK RIVER/LAGRANGE CREEK/LANCASTER CREEK	Low	Medium
F02	SOUTH ANNA RIVER/ROUNDABOUT CREEK	Low	Low
F03	SOUTH ANNA RIVER/TAYLORS CREEK	Low	Low
F05	NEWFOUND RIVER	Low	Low
F06	UPPER NORTH ANNA RIVER	Low	Low
F07	LAKE ANNA/PAMUNKEY CREEK	Low	Low
F09	LOWER NORTH ANNA RIVER/NORTHEAST CREEK	Low	Low
F10	UPPER LITTLE RIVER	Low	Low
F14	LOWER PAMUNKEY RIVER	Low	High
F16	PO RIVER	Low	Medium
F17	UPPER MATTAPONI RIVER/PONI RIVER	Low	High
F18	MATTA RIVER	Low	Low
F21	MATTAPONI RIVER/HERRING CREEK/CHAPEL CREEK	Low	Medium
F22	MARACOSSIC CREEK/BEVERLY RUN	Low	High
F23	MATTAPONI RIVER/GARNETTS CREEK	Low	High
F24	MATTAPONI RIVER/COURTHOUSE CREEK	Low	High
F25	LOWER MATTAPONI RIVER	Low	Low
G04	JAMES RIVER/WARDS CREEK/UPPER CHIPPOKES CREEK	Low	High
G09	UPPER DIASCUND CREEK/DIASCUND CREEK RESERVOIR	Low	Low
G14	WESTERN BRANCH RESERVOIR	Low	Medium
H01	JAMES RIVER/REED CREEK	Low	Low
H02	PEDLAR RIVER	Low	High
H06	WRECK ISLAND CREEK	Low	Low
H07	BENT CREEK	Low	Low
H08	JAMES RIVER/DAVID CREEK	Low	Low
H10	PINEY RIVER	Low	Low
H11	UPPER BUFFALO RIVER	Low	Low
H12	LOWER BUFFALO RIVER	Low	Low
H13	LOWER TYE RIVER/RUCKER RUN	Low	Low
H14	JAMES RIVER/SYCAMORE CREEK	Low	Low
H15	NORTH FORK ROCKFISH RIVER/SOUTH FORK ROCKFISH RIVER	Low	Low

Watershed ID	Watershed Name	NPS Ranking	Natural Heritage Ranking
H16	LOWER ROCKFISH RIVER	Low	Low
H17	JAMES RIVER/TOTIER CREEK/ROCK ISLAND CREEK	Low	Low
H19	HARDWARE RIVER	Low	Low
H20	JAMES RIVER/BEAR GARDEN CREEK/SOUTH CREEK	Low	Low
H21	UPPER SLATE RIVER	Low	Low
H22	LOWER SLATE RIVER	Low	Low
H24	MOORMANS RIVER	Low	Medium
H25	BUCK MOUNTAIN CREEK	Low	Low
H27	NORTH FORK RIVANNA RIVER/SWIFT RUN/PREDDY CREEK	Low	Low
H30	MECHUNK CREEK	Low	Low
H32	CUNNINGHAM CREEK	Low	Low
H33	JAMES RIVER/DEEP CREEK/MUDDY CREEK	Low	Medium
H34	BYRD CREEK	Low	Low
H35	UPPER WILLIS RIVER	Low	Low
H36	LOWER WILLIS RIVER	Low	Low
H37	BIG LICKINGHOLE CREEK	Low	Low
I02	BACK CREEK	Low	Medium
I03	LAKE MOOMAW/HUGHES DRAFT	Low	Medium
I05	CEDAR CREEK	Low	Low
I06	COVE CREEK/SWEET SPRINGS CREEK	Low	Low
I07	DUNLAP CREEK	Low	Low
I08	OGLE CREEK	Low	Low
I10	UPPER POTTS CREEK	Low	High
I11	LOWER POTTS CREEK	Low	Medium
I12	UPPER COWPASTURE RIVER	Low	Medium
I13	BULLPASTURE RIVER	Low	Medium
I14	COWPASTURE RIVER/THOMPSON CREEK/DRY RUN	Low	Medium
I16	COWPASTURE RIVER/MILL CREEK	Low	Medium
I17	LOWER COWPASTURE RIVER/SIMPSON CREEK/PADS CREEK	Low	Medium
I19	UPPER CRAIG CREEK	Low	Medium
I21	JOHNS CREEK	Low	High
I22	LOWER CRAIG CREEK/PATTERSON CREEK/LOWER BARBOURS	Low	High
I23	UPPER BARBOURS CREEK	Low	Low
I24	JAMES RIVER/LAPSLEY RUN	Low	Low
I27	JAMES RIVER/JENNINGS CREEK	Low	Low
I29	UPPER CALFPASTURE RIVER	Low	Low

Watershed ID	Watershed Name	NPS Ranking	Natural Heritage Ranking
I30	LOWER CALFPASTURE RIVER/MILL CREEK	Low	Medium
I31	BRATTONS RUN	Low	Low
I32	LITTLE CALFPASTURE RIVER	Low	Medium
I36	SOUTH RIVER	Low	Medium
J01	UPPER APPOMATTOX RIVER	Low	Medium
J02	BUFFALO CREEK/SPRING CREEK	Low	Low
J03	SANDY RIVER	Low	Low
J04	BUSH RIVER	Low	Low
J05	BRIERY CREEK	Low	Low
J06	APPOMATTOX RIVER/BIG GUINEA CREEK/SAYLERS CREEK	Low	Low
J08	FLAT CREEK	Low	Low
J09	NIBBS CREEK	Low	Low
J10	APPOMATTOX RIVER/SMACKS CREEK/SAPPONY CREEK	Low	Low
J11	DEEP CREEK	Low	Low
J12	LAKE CHESDIN/WINTERPOCK CREEK/WINTICOMACK CREEK	Low	Low
J13	NAMOZINE CREEK	Low	Low
J14	LAKE CHESDIN/WHIPPONOCK CREEK	Low	Low
K01	SOUTH MEHERRIN RIVER/MIDDLE MEHERRIN RIVER	Low	Medium
K02	NORTH MEHERRIN RIVER	Low	Medium
K03	UPPER MEHERRIN RIVER/FLAT ROCK CREEK/MASON CREEK	Low	Low
K04	MEHERRIN RIVER/STONY CREEK/TAYLORS CREEK	Low	Low
K06	GREAT CREEK	Low	Low
K08	MEHERRIN RIVER/REEDY CREEK	Low	Low
K10	UPPER FONTAINE CREEK/RATTLESNAKE CREEK	Low	Low
K11	MIDDLE FONTAINE CREEK/CATTAIL CREEK/BEAVERPOND CREEK	Low	High
K14	UPPER NOTTOWAY RIVER/BIG HOUNDS CREEK	Low	High
K15	LITTLE NOTTOWAY RIVER	Low	Low
K17	NOTTOWAY RIVER/WAQUA CREEK	Low	Low
K18	STURGEON CREEK	Low	Low
K19	NOTTOWAY RIVER/BUCKSKIN CREEK/HARRIS SWAMP	Low	High
K20	BUTTERWOOD CREEK/WHITE OAK CREEK	Low	Medium
K21	STONY CREEK/SOUTHWEST SWAMP	Low	Medium
K22	SAPPONY CREEK	Low	Medium
K23	NOTTOWAY RIVER/ROWANTY CREEK/JONES HOLE SWAMP	Low	High
K24	NOTTOWAY RIVER/HUNTING QUARTER SWAMP	Low	High
K25	RACCOON CREEK/SPRING CREEK	Low	Low

Watershed ID	Watershed Name	NPS Ranking	Natural Heritage Ranking
K26	UPPER THREE CREEK/OTTERDAM SWAMP	Low	Medium
K27	LOWER THREE CREEK/ANGELICO CREEK/POPLAR SWAMP	Low	Low
K29	ASSAMOOSICK SWAMP	Low	Low
K32	UPPER BLACKWATER RIVER/CYPRESS SWAMP	Low	High
K33	MIDDLE BLACKWATER RIVER	Low	High
K34	RATTLESNAKE SWAMP/MILL SWAMP	Low	High
K35	SEACOCK SWAMP	Low	High
K36	LOWER BLACKWATER RIVER/KINGSALE SWAMP/CORROWAUGH	Low	High
K37	UPPER CHOWAN RIVER/BUCKHORN CREEK	Low	Low
K38	SOMERTON CREEK	Low	High
K39	DISMAL SWAMP/CYPRESS SWAMP	Low	High
L01	SOUTH FORK ROANOKE RIVER/BOTTOM CREEK/ELLIOTT CREEK	Low	High
L02	NORTH FORK ROANOKE RIVER/BRADSHAW CREEK	Low	High
L08	UPPER BLACKWATER RIVER	Low	Medium
L10	LOWER BLACKWATER RIVER/SMITH MOUNTAIN LAKE	Low	Low
L11	GILLS CREEK	Low	Low
L13	LEESVILLE LAKE/OLD WOMANS CREEK	Low	Low
L14	UPPER PIGG RIVER	Low	High
L15	BIG CHESTNUT CREEK/LITTLE CHESTNUT CREEK	Low	Medium
L16	MIDDLE PIGG RIVER	Low	Medium
L17	SNOW CREEK/TURKEYCOCK CREEK	Low	Low
L18	LOWER PIGG RIVER	Low	Medium
L19	ROANOKE RIVER/SYCAMORE CREEK	Low	Low
L20	UPPER GOOSE CREEK	Low	Low
L21	MIDDLE GOOSE CREEK/BORE AUGER CREEK/WOLF CREEK	Low	Medium
L22	LOWER GOOSE CREEK	Low	Low
L23	UPPER BIG OTTER RIVER	Low	Low
L24	NORTH OTTER CREEK	Low	Medium
L28	LOWER BIG OTTER RIVER	Low	Low
L30	ROANOKE RIVER/STRAIGHTSTONE CREEK/CHILDREY CREEK	Low	Medium
L31	SENECA RIVER	Low	Low
L32	UPPER FALLING RIVER	Low	Medium
L33	SOUTH FORK FALLING RIVER	Low	Low
L34	LOWER FALLING RIVER/LITTLE FALLING RIVER	Low	Low
L35	MOLLEYS CREEK	Low	Low
L36	ROANOKE RIVER/TURNIP CREEK/CATAWBA CREEK	Low	Low

Watershed ID	Watershed Name	NPS Ranking	Natural Heritage Ranking
L37	CUB CREEK	Low	Medium
L38	ROANOKE RIVER/HUNTING CREEK/WALLACE BRANCH	Low	Low
L39	ROANOKE CREEK/HORSEPEN CREEK/WARDS FORK CREEK	Low	Medium
L40	ROANOKE RIVER/SANDY CREEK	Low	Low
L41	DIFFICULT CREEK	Low	Low
L42	UPPER DAN RIVER/LITTLE DAN RIVER	Low	High
L43	UPPER SOUTH MAYO RIVER/RUSSELL CREEK	Low	High
L44	SPOON CREEK	Low	Low
L45	LOWER SOUTH MAYO RIVER	Low	Medium
L46	NORTH MAYO RIVER	Low	Medium
L47	HORSE PASTURE CREEK	Low	Low
L48	MAYO RIVER	Low	Low
L50	UPPER SMITH RIVER	Low	High
L51	SMITH RIVER/PHILPOTT RESERVOIR/RENNET BAG CREEK	Low	Medium
L52	SMITH RIVER/TOWN CREEK/BLACKBERRY CREEK	Low	Low
L55	MARROWBONE CREEK	Low	Low
L62	DAN RIVER/SANDY CREEK (EAST)/WINNS CREEK	Low	Low
L63	BIRCH CREEK	Low	Low
L65	UPPER BANISTER RIVER	Low	Low
L66	CHERRYSTONE CREEK	Low	Low
L67	MIDDLE BANISTER RIVER/ELKHORN CREEK	Low	Medium
L68	WHITEHORN CREEK	Low	Low
L70	SANDY CREEK	Low	Low
L72	TERRIBLE CREEK	Low	Low
L73	DAN RIVER/AARONS CREEK	Low	Medium
L74	HYCO RIVER/BIG BLUEWING CREEK/MAYO CREEK	Low	Low
L76	BUFFALO CREEK	Low	Low
L77	BLUESTONE CREEK/LITTLE BLUESTONE CREEK	Low	Medium
L80	LAKE GASTON/GREAT CREEK	Low	Low
L81	LAKE GASTON/POPLAR CREEK	Low	Low
L82	LAKE GASTON/PEA HILL CREEK	Low	Low
M01	FISHER RIVER/LITTLE FISHER RIVER	Low	Low
M02	STEWARTS CREEK/PAULS CREEK/LOVILLS CREEK	Low	Medium
N16	NEW RIVER/CLAYTOR LAKE/MACKS CREEK	Low	Low
N17	PEAK CREEK	Low	Low
N22	NEW RIVER/TOMS CREEK/BACK CREEK/STROUBLES CREEK	Low	High

Watershed ID	Watershed Name	NPS Ranking	Natural Heritage Ranking
N26	KIMBERLING CREEK	Low	Medium
N27	LITTLE WALKER CREEK	Low	Low
N28	STONY CREEK	Low	Medium
N29	NEW RIVER/EAST RIVER	Low	Low
N31	HUNTING CAMP CREEK	Low	Low
N32	LOWER WOLF CREEK/CLEAR FORK	Low	Low
N33	LAUREL CREEK	Low	Low
N34	RICH CREEK	Low	Low
N35	NEW RIVER/ADAIR RUN	Low	Low
N36	UPPER BLUESTONE RIVER	Low	Low
N37	BLUESTONE RIVER/LAUREL FORK	Low	Low
O03	UPPER MIDDLE FORK HOLSTON RIVER	Low	Low
P02	CLINCH RIVER/INDIAN CREEK	Low	High
P08	DUMPS CREEK	Low	Low
P10	LICK CREEK	Low	Low
P12	STONY CREEK	Low	Medium
P16	CLINCH RIVER/BLACKWATER CREEK	Low	Low
P18	SOUTH FORK POWELL RIVER	Low	Medium
P19	POWELL RIVER/CAMP CREEK	Low	Medium
P21	POWELL RIVER/HARDY CREEK	Low	High
P22	WALLEN CREEK	Low	High
P23	POWELL RIVER/MARTIN CREEK	Low	High
P24	POWELL RIVER/INDIAN CREEK	Low	Medium
O01	DRY FORK/JACOBS FORK/HORSEPEN CREEK	Low	Low
O02	TUG FORK	Low	Low
O03	KNOX CREEK	Low	Low
O04	UPPER LEVISA FORK/GARDEN CREEK	Low	Low
O05	DISMAL CREEK	Low	Low
O06	LEVISA FORK/PRATER CREEK	Low	Low
O07	SLATE CREEK	Low	Low
O08	LEVISA FORK/HOME CREEK/BULL CREEK	Low	Low
O09	UPPER RUSSELL FORK	Low	Low
O10	RUSSELL FORK/LICK CREEK/FRYINGPAN CREEK	Low	Low
O11	MCCLURE RIVER/CANEY CREEK	Low	Low
O12	RUSSELL FORK/RUSSELL PRATER CREEK	Low	Medium
O14	CRANESNEST RIVER	Low	Low

Chapter 3.5 ESTUARY AND COASTAL ASSESSMENT AND PROGRAM INITIATIVES

The Commonwealth of Virginia has 120 miles of Atlantic Ocean coastline and almost 2,500 square miles of estuary. This resource has a prominent place in both Virginia's history and culture. It is valued for its commercial fishing, wildlife, sporting, and recreational opportunities, as well as its commercial values in shipping and industry. In the late 1970's, adverse trends in water quality and living resources were noted and prompted creation of the Federal-Interstate Chesapeake Bay Program (CBP).

Through participation in the CBP and implementation of special state initiatives, Virginia maintains a firm commitment to rehabilitate and wisely manage its estuarine resources. Because nearly all of Virginia's estuarine waters flow into the Chesapeake Bay, the activities of the CBP apply to Virginia's estuaries in general. This chapter provides an overview of the state's strategies and activities intended to cleanse and preserve the Chesapeake Bay and its tidal tributaries.

Chesapeake Bay Program

In 1983, Virginia, Maryland, Pennsylvania, the District of Columbia, the Environmental Protection Agency, and the Chesapeake Bay Commission formally agreed, by signing the Chesapeake Bay Agreement, to undertake the restoration and protection of the Bay using a cooperative Chesapeake Bay Program approach. This approach established specific mechanisms for its coordination among the Program participants. Recognizing the need for an expanded and refined commitment to the Bay's restoration, a new Bay Agreement was signed in 1987. The new agreement contained goals and priority commitments in six areas: **Living Resources; Water Quality; Population Growth and Development; Public Information, Education, and Participation; Public Access; and Governance.**

A key Water Quality goal established by the 1987 Agreement was to reduce, by the year 2000, the annual nutrient load of nitrogen and phosphorus entering the Bay from controllable sources by 40%. The starting point, or "baseline", for this reduction effort is the sum total of 1985 point source loads (discharges from municipal and industrial treatment plants) and non-point source loads (runoff from agricultural, forested and urban areas) in an average rainfall year. Achieving this 40% reduction is expected to improve dissolved oxygen levels and water clarity conditions in the Bay which in turn will help improve the habitats and health of living resources.

In 1992, the nutrient reduction goal was reevaluated using information from a variety of sources, most notably water quality monitoring and modeling programs. As a result, the Bay Program's Executive Council, comprised of the governors of Maryland, Pennsylvania, and Virginia; the mayor of the District of Columbia; the administrator of the EPA, representing the federal government; and the chairman of the Chesapeake Bay Commission, reaffirmed its commitment to the 40% goal in a set of 1992 Amendments to the Bay Agreement. The Amendments also directed that tributary-specific nutrient reduction strategies be developed to achieve and maintain the goal, as well as to protect and improve aquatic habitats within those rivers.

In Virginia, the Department of Environmental Quality (DEQ) has primary responsibility for point source discharge issues, bringing together programs in the areas of surface and groundwater protection, waste management, and air pollution control. The Department of Conservation and Recreation (DCR) has the lead for nonpoint source control programs. Other state agencies that provide vital support include: Game and Inland Fisheries, Forestry, Health, Chesapeake Bay Local Assistance, Marine Resources Commission, Agriculture and Consumer Services, along with higher education units Virginia Institute of Marine Science and Old Dominion University. Staff from these state agencies represent Virginia on a variety of subcommittees and technical workgroups of the interstate CBP.

Virginia's Tributary Strategy Process

Virginia regards the reduction of nutrients through the tributary strategy program as a high priority. The Commonwealth is committed to achieving substantial nutrient reductions in the drainage basins of the Shenandoah and Potomac Rivers as well as the lower tributaries and smaller coastal basins of the Bay. While the strategy for each basin will differ, the development process and the principles behind that process will remain uniform. Agencies under the Secretary of Natural Resources continue to work closely with local governments, Planning District Commissions, Soil and Water Conservation Districts, sanitation and wastewater authorities, conservation and river-user groups, and other stakeholders to develop strategies that are practical, equitable, and cost-effective. Virginia continues to emphasize a cooperative approach and thus, participation in the development and implementation of tributary strategies remains strictly voluntary.

The reevaluation of the Bay wide nutrient reduction goal, conducted in 1991-92, which lead to the adoption of the 1992 Amendments, yielded an important finding about Virginia's tributaries and their impact on the Bay's water quality. It was determined that the nutrient loads from the Potomac River basin and basins to the north have the greatest influence on dissolved oxygen conditions in the Bay, whereas the southerly tributaries -- the Rappahannock, York, James and small coastal basins -- contribute little, if any, to the Bay's water quality problems in terms of excess nutrient impacts.

For this reason, Virginia has taken a two-pronged approach towards its tributary strategies. These include a concentrated effort in the Shenandoah-Potomac basin to meet the 40% goal and, at the same time, expanding the monitoring and modeling efforts in the lower tributaries to help determine appropriate nutrient reduction goals, as needed, to enhance water quality within these rivers themselves.

The expanded monitoring was completed in 1994 and the watershed model is currently in the final stage of refinement. The latest estimate for tributary specific water quality information for Virginia's lower tributaries will be available by mid -1998 for the purpose of lower tributary nutrient reduction goal setting. The goal setting process, and the final nutrient reduction goal for each of the lower tributaries, will reflect both the unique water quality and habitat conditions of each tributary, and its present and probable future patterns of land and water uses. Until the final modeling data is available, the lower tributary strategies will proceed using 40% as an interim reduction goal.

Shenandoah-Potomac Tributary Nutrient Reduction Strategy

In December of 1996, Virginia completed and submitted the first of its tributary strategies. The Shenandoah and Potomac River Basin Tributary Nutrient Reduction Strategy (Strategy) was the culmination of three years of cooperative work among several of the Commonwealth's Natural Resources agencies, local government officials and other interested citizens and stakeholders. The Strategy outlines a series of management actions, for both point and nonpoint sources of nutrients, that are needed to achieve the 40% nutrient reduction goal established by the Chesapeake Bay Program for this river basin. Currently, efforts are being focussed on assisting localities and others in developing grant applications for funding to implement their recommended nutrient reduction strategies.

Virginia's strategy process is an ongoing effort, with the objective being to address the need for nutrient reduction, as well as maintain the load "cap" once achieved, through development and expansion of management programs that are feasible, equitable, and cost-effective.

Virginia Legislative Actions Supporting the Tributary Strategy Program

- Virginia Tributary Strategies Legislation

The 1996 Virginia General Assembly amended the Code of Virginia (§2.1-51.12:1-3) to provide specific direction to the development of Tributary Plans. This Article outlined the required

contents for tributary plans, provided developmental deadlines for Virginia's lower tributary plans, and set a January 1, 1997 deadline for the Potomac River Basin. In February 1997, the Article itself was amended to extend the deadlines for completion of the lower tributary and coastal basin strategies. The amended deadlines are: Rappahannock River Basin, January 1, 1999; York River Basin, July 1, 1998; James River Basin, July 1, 1998; and the Eastern and Western Coastal Basins, January 1, 1999.

- Virginia Water Quality Improvement Act of 1997

Motivated by the need to finance the completed Shenandoah-Potomac River Nutrient Reduction Strategy and the lower basin strategies still being developed, the Governor introduced a bill during the 1997 VA General Assembly, to aid the financing of Virginia's tributary strategy program. The resulting legislation was the Virginia Water Quality Improvement Act of 1997 which the Governor signed into law on March 20, 1997.

The Act recognizes that the protection of the quality of state waters is a responsibility shared among state and local governments, as well as individuals. In order to enhance the purposes of the State Water Control Board and the other state laws related to the restoration, protection and improvement of the quality of state waters, the Act established cooperative programs to reduce nutrients and other point and nonpoint sources of pollution.

Under the cooperative point source program, DEQ is directed to assist local governments and individuals in the control of point source pollution, including nutrient reductions, through technical and financial assistance.

- Water Quality Improvement Fund

The Virginia Water Quality Improvement Act of 1997 also established the Virginia Water Quality Improvement Fund (WQIF). The purpose of the fund is to provide grants to local governments, soil and water conservation districts and individuals for point and nonpoint source pollution prevention and reduction programs. Under the Act, the Director of DEQ is responsible for point source grants and the Director of DCR is responsible for nonpoint source grants.

In accordance with the Act, until tributary strategies are developed and implemented, the DEQ Director is only authorized to distribute point source grants from the WQIF that provide at least 50% of the cost of design and installation of biological nutrient removal (BNR) facilities or other nutrient removal technology at publicly owned treatment works (POTWs). During Fiscal Year 1998 the only POTWs eligible for funding are those located in the Shenandoah and Potomac basins. The reasoning behind this decision stems from the fact that reduction strategies for these basins are the only ones which have been completed at this time. The Act does, however, allow the Director to authorize point source grants at anytime and in any basin for technical assistance relating to nutrient reduction.

Twenty applications, requesting a total of $59.63 million in grant funds, were received by the August 1997 submission deadline. Of the applications received, sixteen were for installation of nutrient removal facilities at POTWs; three were jointly submitted for a new public-private land application process that would serve two localities and two industries; and one application was received for a technical assistance grant. As a result of preliminary review of the applications, seventeen (17) were selected for funding consideration. All approved WQIF Grant agreements will be made available for public review and comment for at least 30 days prior their execution, and will be governed by a legally binding, enforceable agreement as required by the Water Quality Improvement Act.

Nutrient Loadings

Since Virginia began working toward reducing nutrient loadings to the Chesapeake Bay and its

tributaries, significant nutrient reductions have been achieved. Much of these nutrient reductions can be attributed to greater use of best management practices (BMPs) by farmers and foresters, enhanced nutrient removal, including biological nutrient removal (BNR), at wastewater treatment plants, the 1988 phosphate detergent ban, Virginia's adoption of water quality standards for ammonia, improved erosion and sediment control programs, and other initiatives.

Table 3.5-1 presents the 1985 vs 1996 nitrogen and phosphorus loads discharged from point sources within each of Virginia's tributary basins to the Chesapeake Bay. The table also shows the percent change in loads from the 1985 baseline.

Table 3.5 - 1 1985/1996 Virginia Point Source Nutrient Loads, with percent changes from 1985 baseline.

RIVER BASIN	# OF SOURCES	PHOSPHORUS (LBS / YR)		PHOSPHORUS % CHANGE FROM 1985	NITROGEN (LBS / YR)		NITROGEN % CHANGE FROM 1985
		1985	1996		1985	1996	
Potomac	32	690,000	453,000	-34%	10,702,000	11,617,000	+9%
Rappahanock	11	181,000	81,000	-55%	477,000	597,000	+25%
York	8	421,000	204,000	-52%	1,309,000	1,765,000	+35%
James	32	3,590,000	1,557,000	-57%	23,534,000	19,596,000	-17%
Coastal	8	297,000	167,000	-44%	1,303,000	1,945,000	+49%
TOTAL	91	5,179,000	2,462,000	-52%	37,325,000	35,519,000	-5%

The overall percent reduction for point source phosphorus loads between 1985 and 1996 is 52%, and for nitrogen it is 5%. These loading reductions have been achieved even with an increase of more than 20% in wastewater flows during those eleven years. This demonstrates that nutrient reductions have proceeded over the past decade even without the benefit of completed tributary strategies. With the completion of the Shenandoah-Potomac Strategy at the end of 1996, the rate of nutrient reduction in that basin is expected to accelerate significantly. Once strategies are completed for the other river basins, the pace of nutrient reduction in those basins should also accelerate.

Water Quality and Habitat Monitoring Program

The Chesapeake Bay Program (CBP) provides information to guide the implementation of nutrient and toxics reduction strategies. The purpose of the Water Quality and Habitat Monitoring Program is to assess trends in water quality and organism abundance throughout the Virginia portion of the Bay. The productivity, diversity, and abundance of living resources are the ultimate measures of the Chesapeake Bay's condition. Monitoring these organisms along with standard chemical and physical indicators of water quality can help determine the conditions that must be established and maintained to ensure the well-being of the Bay's resources. As a part of this program, 40 tributary stations were sampled in 1993, 59 tributary stations were sampled in 1994 and 38 tributary stations were sampled in 1995. Virginia began fall line monitoring for nutrients in July 1988 on the James and Rappahannock Rivers under contract with the U.S. Geological Survey (USGS). Fall line monitoring for nutrients began in July 1989 in the Appomattox, Mattaponi, and Pamunkey Rivers. The frequency of sampling is increased during storm events, when large amounts of sediments and nutrients may be transported into the tidal portion of the watershed. USGS is utilizing the sampling data to develop accurate estimates of nutrient loads entering the Bay from above the fall line.

All mainstem Bay stations are sampled under contract by two universities. The Applied

Marine Research Laboratory at Old Dominion University sample 8 stations within the Bay and the Virginia Institute of Marine Science sample 19 stations. Water quality measurements include Secchi depth, temperature, salinity, chlorophyll, dissolved oxygen, nitrogen, phosphorus, carbon, and silica.

In order to develop better and more creditable tributary models, additional data needs were identified and the 1994 Virginia Enhanced Tributary Monitoring Program (VETMP) was designed.

The VETMP was a component of the ongoing water quality monitoring programs conducted by the Commonwealth of Virginia and its contractors. It consists of several important enhancements. First, since the existing tributary monitoring data are collected along the axis of the tributary channels, transects were added to enhance spatial coverage to include the shallow flanks and embayments where the majority of critical habitat and living resources are found. Secondly, the detection levels used in the 1993 tributary monitoring program restricted the amount of nutrient data available for modeling purposes because detection limits for ammonia, nitrate-nitrite, and dissolved inorganic phosphorus are above the water quality model calibration values. Third, the parameter list "was expanded" to include field measurements of particulate inorganic phosphorus (PIP), biogenic silica (BioSi) and direct measurements of carbon (POC and DOC) for the fall line and tributary stations. And fourth, a light attenuation meter was used and the initiation of field filtration of water samples which allow direct analysis of dissolved and particulate nitrogen and phosphorous in Virginia's tributaries. This enhanced data will be used to improve the 3D Model's capability to simulate water quality conditions in the tidal portions of the James, York, and Rappahannock Rivers.

VETMP began January 1, 1994 and ended December 31, 1994. The 1993 Virginia Tributary Monitoring Programs station list was augmented by including transects at eight existing tidal tributary stations, transects at the mouth of each tributary and adding four new main channel station locations. Monthly water quality sampling occurred at all of the stations and transects. All sampling was conducted by personnel from DEQ Regional Offices, ODU and VIMS. Routine water quality parameters were analyzed by DCLS, chlorophyll analysis was performed at VCU, and special parameter analysis preformed by VIMS.

The only change within the main Bay stations, was the inclusion of PIP and BioSi during six sampling runs, with emphasis during the 1994 spring and summer months.

In 1995, all transect stations were discontinued along with three parameters (DOC, PIP and BioSi). Some of the new main channel stations remained active as CBM or AWQM stations due to the Department's further need for water quality information in these areas of the state. Sampling is conducted monthly with all filtration now being done on the boats. Light attenuation continues to be measured, and DCLS now does all analyses (except chlorophyll a) for the program.

A general description of the current monitoring regime is provided below:

- Water quality monitoring at 38 stations on the Rappahannock, York and James Rivers;
- Water quality monitoring at 27 stations in the Chesapeake Bay proper;
- Water quality monitoring and estimates of nutrient loading at the fall lines of the James, Appomattox, Mattaponi, Pamunkey, and Rappahannock Rivers;
- Monitoring of plankton communities in the mainstem of the Chesapeake Bay at 7 stations and in the tributaries at 6 stations;
- Monitoring of benthic communities in the Bay and its tributaries at 19 stations;
- Monitoring of chlorophyll a in the bay and its tributaries at all stations.

Toxics Reduction and Prevention Strategy

In 1989, the Executive Council adopted the Chesapeake Bay Basin wide Toxics Reduction Strategy called for in the 1987 Chesapeake Bay Agreement. The initial strategy focused on defining the nature, extent, and magnitude of chemical contaminant problems in the Chesapeake Bay and initiating specific chemical contaminant reduction and prevention actions. During the 1992 reevaluation, noted progress from toxics management activity included some chemical contaminant reductions in living resources and their habitats. In addition, there was little evidence of chemical contaminants causing severe, system wide impacts on the Bay. However, a few well-known areas were determined to have serious, localized chemical contaminant problems, and some areas that were previously thought to be uncontaminated showed some toxic effects.

Based on the reevaluation, the Executive Council adopted the Chesapeake Bay Basin wide Toxics Reduction and Prevention Strategy in October 1994. The goal was established to have the "*Bay free of toxics by reducing and eliminating the input of chemical contaminants from all controllable sources to levels that result in no toxic or bioaccumulative impact on living resources that inhabit the Bay or on human health*." The revised strategy includes the following actions: a Regional Focus- to address toxic problem areas; Directed Toxics Assessments- enhanced focus on biological and chemical contaminant assessments in direct support of management actions; Regulatory Program Implementation- complementary activity with existing toxics regulations; and, Pollution Prevention- increasing emphasis as a means of preventing the introduction of toxics into the Bay.

Regional Focus - The Elizabeth River Regional Action Plan for Toxics Reduction

The Elizabeth River, a sub-estuary of the James River, is the major deep water port of the Hampton Roads Harbor. The river system drains over 300 square miles in southeastern Virginia within the cities of Chesapeake, Norfolk, Portsmouth, and Virginia Beach. The Elizabeth River serves as the focal point for military activities, industry, and commerce in the Hampton Roads area. The watershed is among the most heavily urbanized and industrialized areas in the state.

In 1993, the Chesapeake Bay Program identified the Elizabeth River system as one of the most highly polluted bodies of water in the entire Bay watershed. In March 1995, the Commonwealth of Virginia entered into an agreement with the Elizabeth River Project (ERP), a private nonprofit organization, to recommend actions toward an Elizabeth River Regional Action Plan for Toxics Reduction. ERP, a Norfolk-based partnership of citizens, industry, governments, military, and recreational interests, had independently formed to develop an integrated watershed action plan for management of ecological and human health risk.

As a result of the agreement between the Commonwealth and ERP, an 18-item Watershed Action Plan was developed and presented in 1996. The eighteen individual actions are listed in Table 3.5-2. The Plan was the culmination of a year long effort by an ERP volunteer Watershed Action Team working in four task forces: a Habitat & Living Resources Task Force; a Sediment Quality Task Force; a Water Quality Task Force; and a Toxics Reduction Task Force. Actions presented by the team were chosen on the basis of three main criteria: effectiveness, afford ability and acceptability to the community.

Of the eighteen actions, Actions 1, 2, 5, 6, and 14 were identified by the Action Team as "critical areas" deserving the most initial resources. Some progress highlights include the following:

Actions 1 & 2 -An Elizabeth River initiative to remediate the river's toxic sediments and restore wetlands. These actions are to be conducted by the US Army Corps of Engineers and sponsored through a federal, state and local partnership. In 1997, a federally funded assessment by the Corps., identified (5) toxic "hot spots" for sediment cleanup and (14) sites for wetlands restoration.

Action 5 - In 1997 ERP began Businesses for a Cleaner River, a resource and referral service to assist government and business facilities with pollution prevention and wildlife habitat enhancement. Thirty such facilities have committed to developing these types of programs.

Action 6 - Recognizing that stormwater runoff is the leading source of toxics presently entering the Elizabeth River, the ERP has responded by providing educational programs designed to increase awareness in the public and business communities. Funds from the National Environmental Education and Training Foundation, as well as local cities, will pay for an interactive stormwater exhibit at the National Maritime Center in Norfolk, a traveling exhibit and a teacher training program.

Action 13 - $200,000 was allocated by the VA General Assembly in its 1996-1998 budget for the removal of abandoned vessels in the Elizabeth River. The Virginia Marine Resource Commission began the initiative by conducting an extensive inventory which identified 145 abandoned vessels and more than 6,000 abandoned pilings. To date about 8 vessels have been removed, with an additional 8 slated for removal in early 1998.

Action 14 - In its 1996-1998 budget, the VA General Assembly provided $250,000 to enhance toxics monitoring in the Elizabeth River by the Department of Environmental Quality. In response to this initiative, the DEQ developed the first comprehensive monitoring plan for the river. This plan calls for monitoring 38 stations to track trends in water quality, sediment quality, habitat and living resources. Initial monitoring under this plan, slated for 1998, will include about 12 of these stations. In addition to the efforts of DEQ, both Old Dominion University and the Virginia Institute of Marine Science have been awarded grants by NOAA to conduct investigations relating to toxics in sediments.

Table 3.5 - 2 The Eighteen Recommended Actions of the Elizabeth River Watershed Action Plan

Action 1 - ***Reduce sediment contamination in the Elizabeth River to levels non-toxic to humans and aquatic life, remediating the highest priority contaminated sites by 2010.***

Action 2 - ***Increase vegetated buffers, wetlands acreage and forested areas.***

Action 3 - ***Implement habitat enhancement programs at 25% of business and government facilities in the watershed by the year 2005, and enhance backyard habitats.***

Action 4 - ***Minimize erosion along rapidly eroding shorelines by 2010, also rehabilitating existing hardened shorelines to use naturalized erosion measures wherever possible.***

Action 5 - ***Establish pollution prevention and/or sustainable landscaping practices among 25% of residential, commercial and government land users in the watershed by the year 2005.***

Action 6 - ***Reduce pollution from stormwater runoff to the maximum practical extent.***

Action 7 - ***Identify and correct inadequate sanitary collection systems, for the purpose of reducing human health risks anc ecological risks from bacterial contamination in the Elizabeth River.***

Action 8 - ***Reduce TBT to non-toxic levels in the Elizabeth River waters and sediment, while enhancing the opportunity for continued competiveness of Virginia's shipping, shipbuilding and other related businesses.***

Action 9 - ***Promote mass transit and alternate transportation, based on a recognition of automotive usage as a major source of pollution in the Elizabeth River.***

Action 10 - ***Enhance compliance with existing regulations.***

Action 11 - ***Enhance marketability of Hampton Roads through achieving a cleaner environment, working with localities and the Chamber of Commerce's Plan 2007.***

Action 12 - ***Increase public access to the Elizabeth River for the purpose of increasing appreciation of the river and support for restoration.***

Action 13 - ***Remove abandoned vessels and pilings, where possible also conserving or replacing habitat.***

Action 14 - ***Establish and maintain an Elizabeth River monitoring program and data bank to provide the scientific foundation for protecting, restoring and sustaining living resources and human health in the Elizabeth River watershed.***

Action 15 - ***Determine the ecological effects of Craney Island operations on the Elizabeth River, with the purpose of reaching consensus among interested parties about best management practices and remediation needs.***

Action 16 - ***Develop and implement a "load allocation approach" as a voluntary tool for making more informed, more cost-effective decisions on how to manage the Elizabeth River.***

Action 17 - ***Develop a nutrients task force to establish Elizabeth River nutrient goals and basis for goals, and to recommend control measures needed to achieve goals.***

Action 18 - ***Build strong partnerships between the Elizabeth River Project and all public and private authorities relevant to this plan, for the purposes of promoting speedy, effective implementation and enhanced regional watershed planning.***

Additional on-going activity, under the Regional Focus section of the strategy, includes a toxics characterization of the entire tidal Bay watershed. The purpose of this characterization is to determine if additional chemical contaminant problem areas exist, similar to those areas identified as Regions of Concern (e.g., Elizabeth River) or Areas of Emphasis (areas with the potential for serious chemical contaminant-related impacts). Based on the results of the regional focus characterization, future toxics management actions will be considered within the impacted segments.

Directed Toxics Assessment

The CBP's second Toxics Loading and Release Inventory (TLRI) is scheduled to be released in July, 1998. Along with the SARA Title III data, this report will include loading estimates from all Virginia VPDES dischargers in the Bay watershed that have been regulated under the Commonwealth's Toxics Management Program. The effort will also include estimations of toxics loadings to the Bay watershed from non-point sources such as urban stormwater runoff, acid mine drainage, and atmospheric deposition. This information will be compared with the 1994 report although the Virginia portion will be more comprehensive. The report shall provide insight on the effectiveness of Virginia's Programs for eliminating or reducing toxic chemicals in addition to helping managers establish goals toward further contaminant reduction.

The Chesapeake Bay Program annually supports ambient toxicity testing throughout the tidal Bay watershed as the toxic chemical loadings information does not yield information on biological effects. The standardized ambient toxicity program is used to quantify levels of toxicity in the targeted areas. Results for stations sampled during 1995 in Virginia are highlighted in Table 3.5-3 and have been considered in the overall 305(b) assessment. Priority areas for managing toxicity include high toxicity areas (such as the Elizabeth River) and low to moderate toxicity areas that are critical to the Bay's living resources (i.e., spawning areas). Areas showing lower levels of toxicity are not an immediate concern.

Table 3.5-3 1995 Ambient Toxicity Results

SAMPLE LOCATION	MEDIUM	DATE	RESULTS
*Elizabeth River**	Water Column	1990	High Degree of Toxicity
Willoughby Bay		1995	High Degree of Toxicity
Pamunkey River - (Below West Point)		1995	High Degree of Toxicity
James River (Newport News)	Water Column	1995	Low to Moderate Toxicity
York River (Above Cheatham Annex)		1995	Low to Moderate Toxicity
Pamunkey River (Above West Point)	Water Column	1995	No Significant Toxicity
York River (Below Cheatham Annex)		1995	No Significant Toxicity
Lynnhaven River		1995	No Significant Toxicity
*Elizabeth River**	Sediment	1990	High Degree of Toxicity
Willoughby Bay		1995	High Degree of Toxicity
James River (Below Newport News)	Sediment	1995	Low to Moderate Toxicity
Pamunkey River (2 sites)	Sediment	1995	No Significant Toxicity
York River (2 sites)		1995	No Significant Toxicity
James River (Above Newport News)		1995	No Significant Toxicity
Lynnhaven River		1995	No Significant Toxicity

* ***Elizabeth River data included to provide a frame of reference.***

Source: USEPA CBP, Ambient Toxicity Testing in the Chesapeake Bay - Year 5 Report (EPA 903/R/98/008)

Regulatory Program Implementation

The toxics prevention and reduction commitments included in this section of the strategy build upon existing state and federal legislative and statutory mandates. This is applicable to eliminating toxic impacts from point sources and setting reduction targets for nonpoint sources which include atmospheric deposition, stormwater runoff and acid mine drainage. In addition, a list of key chemical contaminants (known as the Toxics of Concern) causing or having the potential to cause adverse problems in the Bay, has been identified. The strategy directs EPA to establish criteria for these contaminants.

Pollution Prevention - Businesses for the Bay

The Toxics Reduction and Prevention Strategy recognizes "pollution prevention" as the preferred approach for addressing the "Toxics of Concern" and reducing chemical releases throughout the Chesapeake Bay watershed. Pollution prevention (or P2) includes a hierarchy of activities and techniques to reduce or eliminate the amount and toxicity of chemicals used at the source of production and the amount of wastes generated. P2 was embraced by the Executive Council because many P2 techniques not only decrease chemical discharges and waste generation, but also result in increased production efficiency and reduced waste disposal costs for businesses. For this reason, business and industry have been the leaders in developing many pollution prevention techniques and are proponents of this voluntary approach to eliminating or reducing the generation of wastes.

Working closely with representatives from business and industry, the EPA Chesapeake Bay Program, DEQ Chesapeake Bay Program and Pollution Prevention staffs helped craft Businesses for the Bay, a voluntary pollution prevention program designed to encourage industry to adopt pollution prevention principles. The Executive Council approved the program in October 1996 and Virginia kicked off its program in January 1997.

Membership in Businesses for the Bay is open to all businesses and other facilities in the Bay watershed, including federal, state, and local government facilities. Each participating facility annually develops its own P2 goals and reports back on its progress of the previous year's efforts. Members not only benefit from cost savings and increased efficiencies, but also from positive publicity, increased patronage, and eligibility for various P2 grants and awards from the Executive Council.

Goals of the program include raising participation in pollution prevention activities to include 75% of all business in the Chesapeake Bay watershed by the year 2000; achieving an aggregate reduction in the amount of chemical releases across the Bay watershed for Toxic Release Inventory chemicals by at least 65% and Bay Toxics of Concern by 75% by the year 2000 (using 1988 as the baseline year); increasing the number of small business participants in pollution prevention; and increasing the number of pollution prevention mentors from the private sector.

During 1997, DEQ's Office of Pollution Prevention actively promoted the Businesses for the Bay program through a variety of approaches, including newsletter and newspaper features, numerous presentations, and direct mailings. As a result of these efforts, Virginia has successfully enrolled 56 program members. In addition, Businesses for the Bay was also the featured business component of the Governor's , an annual promotion of volunteer activities aimed at improving the quality of Virginia's water resources. As part of Fall River Renaissance, DEQ co-sponsored a day-long training workshop for businesses interested in becoming mentors to other business that lack pollution prevention experience and expertise.

All of the initiatives and programs discussed in this chapter have been designed to improve the quality of waters entering the Chesapeake Bay watershed. As previously stated, the primary goal of the Chesapeake Bay Program is to reduce the nutrient loadings entering the Bay by 40%. Likewise, toxic reduction strategies have been designed to help reduce the impact of toxic contaminants on the aquatic life in the Bay and its tributaries. Finally, the efforts to preserve and enhance wetland areas will also

benefit the continued health of aquatic life in the Bay area.

Chapter 3.6 WETLANDS ASSESSMENT and PROGRAM INITIATIVES

Virginia has approximately 1 million acres of wetlands. One quarter of these are tidal wetlands and three quarters are nontidal. Forested wetlands are the most common variety of nontidal wetlands in Virginia. Development in wetlands in Virginia is regulated by the Corps of Engineers through Section 404 permits; the Department of Environmental Quality, through Virginia Water Protection Permits and by the Virginia Marine Resources Commission and local Wetland Boards (tidal wetlands only).

It is estimated that Virginia has lost about 42% of its wetlands since the 1780's (Dahl, 1980). The estimated annual loss of all wetland types between 1955 and 1977 was 3000 acres per year (Tiner, 1987).
This loss of wetland areas has been recognized as being potentially detrimental to Virginia's environment and new ways of mitigating these losses are now being considered and enacted.

For example, several large projects impacting wetlands are under consideration in Virginia. King William Reservoir, if permitted, will impact 437 acres of non tidal wetlands. The project impacts to the wetland areas , as proposed, would be mitigated at a minimum of a two to one ratio. Other large projects under consideration are the Southeastern Virginia expressway in Virginia Beach and Chesapeake with roughly 200 acres of wetland impact and the expansion of the Southeastern Public Service Authority landfill with nearly 377 acres of nontidal impact.

Wetlands Management

Through the Wetlands Act of 1972 (Title 62.1 of the Code of Virginia), the Commonwealth of Virginia defined tidal wetlands for the purposes of protecting the resource and regulating development. Under the Virginia definition, wetlands are found in the 29 counties and 17 cities that comprise Tidewater, Virginia. Specifically, vegetated wetlands are defined as "all land lying between and contiguous to mean low water and an elevation above mean low water equal to the factor 1.5 times the mean tide range at the site of the proposed project in the county, city or town in question," and on which are growing one or more of 37 specified species of wetlands vegetation. Non-vegetated wetlands are defined as all other lands between mean low water and mean high water. The Virginia Wetlands Act of 1972 does not include a definition for non-tidal wetlands. Further, it does not include all lands which are considered to be
wetlands under the federal definition, seasonally tidal areas included. Although the Wetlands Act was initially limited to vegetated tidal wetlands, subsequent amendments included two discrete areas subject to wind tides along the North Landing River and Back Bay in southeastern Virginia.

A definition of Virginia wetlands is contained in the DEQ's Wetlands Policy, as follows:"The wetlands of the Commonwealth, including marshes, swamps, bogs and other low-lying areas, which during some period of the year will be covered in part by natural non-flood waters, are unique, valuable and an irreplaceable natural resource." This definition was modified and included in the Virginia Water Protection Permit (VWPP) regulation (VR 680-15-02) as follows: "Wetlands" means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support and, under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas (VR 680-15-02).

Wetlands Legislation

Tidal Wetlands Act

The Virginia Tidal Wetlands Act of 1972 is codified in Title 28.2, Chapter 13, Code of Virginia, and is administered by the Virginia Marine Resources commission (VMRC). The Act authorizes local governments to establish local wetlands boards which exercise jurisdiction and issue permits for wetlands development, subject to adoption of a model wetlands zoning ordinance. The model ordinance is contained within the enabling legislation and, since Virginia is a "Dillon Rule" state, does not convey any

authority to the locality to be more stringent than the Commonwealth's.

To date, 31 of 46 eligible localities have established local wetland programs. In localities without wetlands boards, permits for wetlands development must be obtained from VMRC. The Commission reviews all decisions made by the local boards and has the authority to modify, remand, or reverse those decisions.

The Act also requires that the Virginia Institute of Marine Science (VIMS) maintain an inventory of vegetated wetlands and provide advice and assistance to the VMRC on projects and on the development of wetland guidelines. The guidelines describe the values of each wetland community type and provide ranking according to the values.

Chesapeake Bay Preservation Act

This legislation created the Chesapeake Bay Local Assistance Department, whose function is to protect water quality and the integrity of the Chesapeake Bay with the creation of Chesapeake Bay Preservation Areas through local government ordinances. These preservation areas serve to restrict development in wetlands associated with free flowing permanent streams and establish buffer zones for these areas. The implementation of the regulations of this Act relies on local governments. The mapping of Virginia's wetlands for this effort is currently being conducted by the DCR-DSWC. This effort has received funding from the General Assembly to map those wetlands not covered by the U. S. Fish and Wildlife Service's Wetlands Inventory.

Virginia Water Protection Permit (VR 680-15-02)

VWPP constitutes the state Water Quality Certification required under section 401 of the Clean Water Act. A VWPP would be issued for an activity requiring section 401 certification if it has been determined that the proposed activity is consistent with the provisions of the Clean Water Act and will protect instream beneficial uses. Activities for which a water quality certificate, and therefore, a VWPP, are required include impacts to wetlands under section 404 of the Act, Section 10 of the Rivers and Harbors Act of 1899, Federal Energy Regulatory Commission licensing, and other appropriate federal permits or licenses.

Regulations for the VWPP were promulgated on May 20, 1992. These regulations replaced the existing 401 regulatory procedures as was contained in the SWCB's Procedural Rule No. 3.

Definition of State Waters

The Virginia Water Protection Regulations (VR 680-15-02) define "surface waters", which are part of the definition of state waters, to include wetlands. This definition has closely followed the federal definition of "waters of the U.S.".

Coordination of Activities

Several state agencies are involved in reviewing activities for which permits may be needed. Among these agencies are the DGIF and DCR-Division of Natural Heritage, which have an interest in aquatic or wetland-dependent species and their habitat. Additionally, the VMRC regulates activities in tidal wetlands and acts as the clearing house for all permit applications. Permitting activities are coordinated with these agencies during cooperative site visits and periodic Joint Permit Application meetings sponsored by the Corps of Engineers.

Wetland Protection Activities

The Commonwealth of Virginia, through the VWPP, applies its authority under section 401 of the Clean Water Act to the following activities:

Section 10 Rivers and Harbors Act
Section 402 Clean Water Act; Homogenous fill
Section 404 Clean Water Act
Federal Energy Regulatory Commission licensing and relicensing projects

Nationwide permits were recertified on January 21, 1992 by the SWCB. Three Nationwides (7, 16, and 17) were denied water quality certification for activities involving intake or outfall structures, return water from upland disposal sites, and FERC hydropower projects, respectively. Two Nationwide permits were conditionally certified. These two nationwides relate to minor road crossings and activities in headwaters and isolated wetlands, and contain language that insures that individual certification may be modified if they prove to be inadequate. With the promulgation of the VWPP regulations, the agency has taken the position that this water quality certification is still in effect.

Since implementation of the VWPP regulations, the state has entered into an agreement with the USDA-SCS, the Corps, VMRC, DGIF and other state agencies, concerning the use of Nationwide 37 (Flood Emergency Projects) which is designed to streamline site review and decision-making while insuring that water resources (including wetlands) are adequately protected.

Nationwide Permit Number 29 for wetland impacts caused by single family homes was conditionally certified in Virginia. This general permit cannot be used to fill in perennial streams, lakes, rivers or other open water bodies.

On July 1, 1995 implementation of the Virginia Water Protection Permit/Section 401 Water Quality Certification was transferred to DEQ's Regional Offices for most types of permits. Exceptions include state highway projects and projects which impact instream flow.

In 1996, the Virginia General Assembly enacted legislation to encourage the use of Wetland Mitigation Banks. These “banks” must be developed in accordance with federal guidance for the creation of wetland mitigation banks. Furthermore, the Virginia General Assembly enacted service area requirements for these banks that required any impacts be in the same hydrologic unit or in an adjacent unit to the bank.

The Great Dismal Swamp Wetland Mitigation Bank is the first new wetland mitigation bank in Virginia to be created subsequent to the issuance of the new Federal Guidance. This bank, mostly in North Carolina, will preserve or restore 8000 acres of wetlands.

In February 1997, the Commonwealth reestablished its position on Section 401 water quality certification relative to the reissued Corps Nationwide Permits. The State maintained its ability to issue individual permits for projects, authorized under Nationwide Permit Number 26, which impact more than one acre of headwater wetlands. This is the same threshold that was in effect with the previous round of Nationwide Permits issued in 1992.

Also in 1997, the State Water Control Board, in conducting its triennial review of water quality standards, created for the first time, a separate category of surface waters defined as “wetlands”. This designation will allow for regulatory protection, as it pertains to water quality associated with designated uses, primarily aquatic life use and swimming and secondary contact recreation use.

The Commonwealth of Virginia, as a state signatory to the Chesapeake Bay Wetlands Policy in 1989, is committed to attaining a net gain in wetlands acreage and functions within the Chesapeake Bay drainage. The newly elected Governor has also committed to achieving a net gain in wetlands during his tenure as Governor.

With these initiatives, the Commonwealth looks to protect its wetlands as they currently exist and will seek to create and protect additional wetland areas within the state.